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Revision 2

Health and Safety Plan for the Accelerated Retrieval Project for a Described Area within Pit 4

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Idaho Completion Project

Bechtel BWXT Idaho, LLC

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Idaho Falls, Idaho 83415

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for the Accelerated Retrieval Project
for a Described Area within Pit 4

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ABSTRACT

This health and safety plan identifies the procedures and requirements used to eliminate or minimize health and safety risks to personnel performing construction and operational tasks within the Accelerated Retrieval Project area in the Subsurface Disposal Area of the Radioactive Waste Management Complex. The Accelerated Retrieval Project is part of the Idaho Completion Project at the Idaho National Engineering and Environmental Laboratory. This plan has been prepared to meet Occupational Safety and Health Administration standards.

This plan contains the assessment and associated mitigation of safety, health, and radiological hazards for conducting operational activities within the Accelerated Retrieval Project area. Safety, health, and radiological professionals assigned to support the Accelerated Retrieval Project will define the most appropriate hazard control and mitigation measures based on operations-specific conditions and will make changes to this plan and associated work control documents as appropriate.

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ACRONYMS

ACGIH	American Conference of Government Industrial Hygienists
ALARA	as low as reasonably achievable
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
dBA	decibel A-weighted
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERO	Emergency Response Organization
GFCI	ground-fault circuit interrupter
HASP	health and safety plan
HAZWOPER	hazardous waste operations and emergency response
HEPA	high-efficiency particulate air
HSO	health and safety officer
IARC	International Agency for Research on Cancer
IDLH	immediately dangerous to life or health
IH	industrial hygiene/industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
ISG	In situ grouting
ISMS	Integrated Safety management system
ISTD	in situ thermal desorption
ISV	In situ vitrification
JSA	job safety analysis
LLW	low-level waste
MCP	management control procedure
MSDS	material safety data sheet
NFM	nuclear facility manager
NIOSH	National Institute of Occupational Safety and Health

NTP	National Toxicology Program
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
PCM	personal contamination monitor
PDSA	Preliminary Documented Safety Analysis
PEL	permissible exposure limit
PPE	personal protective equipment
PVC	polyvinyl chloride
RadCon	Radiological Control
RCIMS	Radiological Control and Information Management System
RCT	radiological control technician
RWMC	Radioactive Waste Management Complex
RWP	radiological work permit
SDA	Subsurface Disposal Area
STEL	short-term exposure limit
STR	subcontractor technical representative
SWP	safe work permit
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TPR	technical procedure
TRU	transuranic
TWA	time-weighted average
UV	ultraviolet
VPP	Voluntary Protection Program
WCC	Warning Communications Center

Health and Safety Plan for the Accelerated Retrieval Project for a Described Area within Pit 4

1. WORK SCOPE

1.1 Purpose

This health and safety plan (HASP) identifies health and safety hazards and requirements used to eliminate or minimize hazards during Accelerated Retrieval Project construction and operations at the Radioactive Waste Management Complex (RWMC). The Accelerated Retrieval Project is part of the Idaho Completion Project at the Idaho National Engineering and Environmental Laboratory (INEEL). This HASP has been written to meet the requirements of the Occupational Safety and Health Administration (OSHA) standard, "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120; 29 CFR 1926.65).

This HASP will address Accelerated Retrieval Project construction and operational hazards and the associated mitigation. This HASP is applicable to all soil invasive construction and all operational activities at the Accelerated Retrieval Project site in the RWMC Subsurface Disposal Area (SDA), unless evaluated and documented as not applicable by the Accelerated Retrieval Project health and safety officer (HSO) based on actual field conditions. This plan provides basic safety and health requirements and mitigations specific to the AR Project, and additional job safety analyses (JSAs), operational technical procedures (TPRs), project work orders, maintenance work orders, program requirements documents, and management control procedures (MCPs) will further define Accelerated Retrieval Project hazards, hazard mitigation, and procedural requirements as new hazards are identified during facility construction and operation. The hazards and associated mitigations identified in this plan will be evaluated by the responsible safety, industrial hygiene (IH), and radiological control professionals for implementation in work control documents as determined applicable. It is not intended that the project work control documents duplicate all of the information in this plan, but rather evaluate and use the information in this plan as a basis for hazard identification and mitigation in the work control development process. This HASP will be reviewed and revised, as appropriate, by the Accelerated Retrieval Project HSO in consultation with Industrial Hygiene, Industrial Safety, and Radiological Control (RadCon) support personnel to ensure its effectiveness and suitability for Accelerated Retrieval Project activities.

1.2 Applicability and Jurisdiction

Project operations will be conducted under the administrative controls of a safety analysis. Technical procedures, JSAs, and other appropriate project health and safety evaluations will be conducted to ensure operations are in compliance with the facility authorization basis. Project operations will fall within the jurisdiction of the RWMC operations director. This HASP applies to all personnel conducting Accelerated Retrieval Project construction and operational activities in these areas.

1.3 Site Description of the Idaho National Engineering and Environmental Laboratory

The INEEL is a U.S. government-owned test site located 53 km (32 mi) west of Idaho Falls in southeastern Idaho (see Figure 1-1) and managed by the U.S. Department of Energy (DOE). The INEEL encompasses approximately 2,305 m^2 (890 mi^2) of the northeastern portion of the Eastern Idaho Snake River Plain. The Eastern Idaho Snake River Plain is a relatively flat, semiarid, sagebrush desert with predominant relief being manifested either as volcanic buttes jutting up from the desert floor or as unevenly surfaced basalt flows or flow vents and fissures. Elevations on the INEEL range from 2,003 m

(6,572 ft) in the southeast to 1,448 m (4,750 ft) in the central lowlands, with an average elevation of 1,516 m (4,975 ft). Drainage within and around the plain recharges the Snake River Plain Aquifer, a sole-source aquifer that flows beneath the INEEL and surrounding area. The aquifer is approximately 137 m (450 ft) below ground surface within the Site boundaries. Regional groundwater flow is southwest at average estimated velocities of 1.5 m/day (5 ft/day).

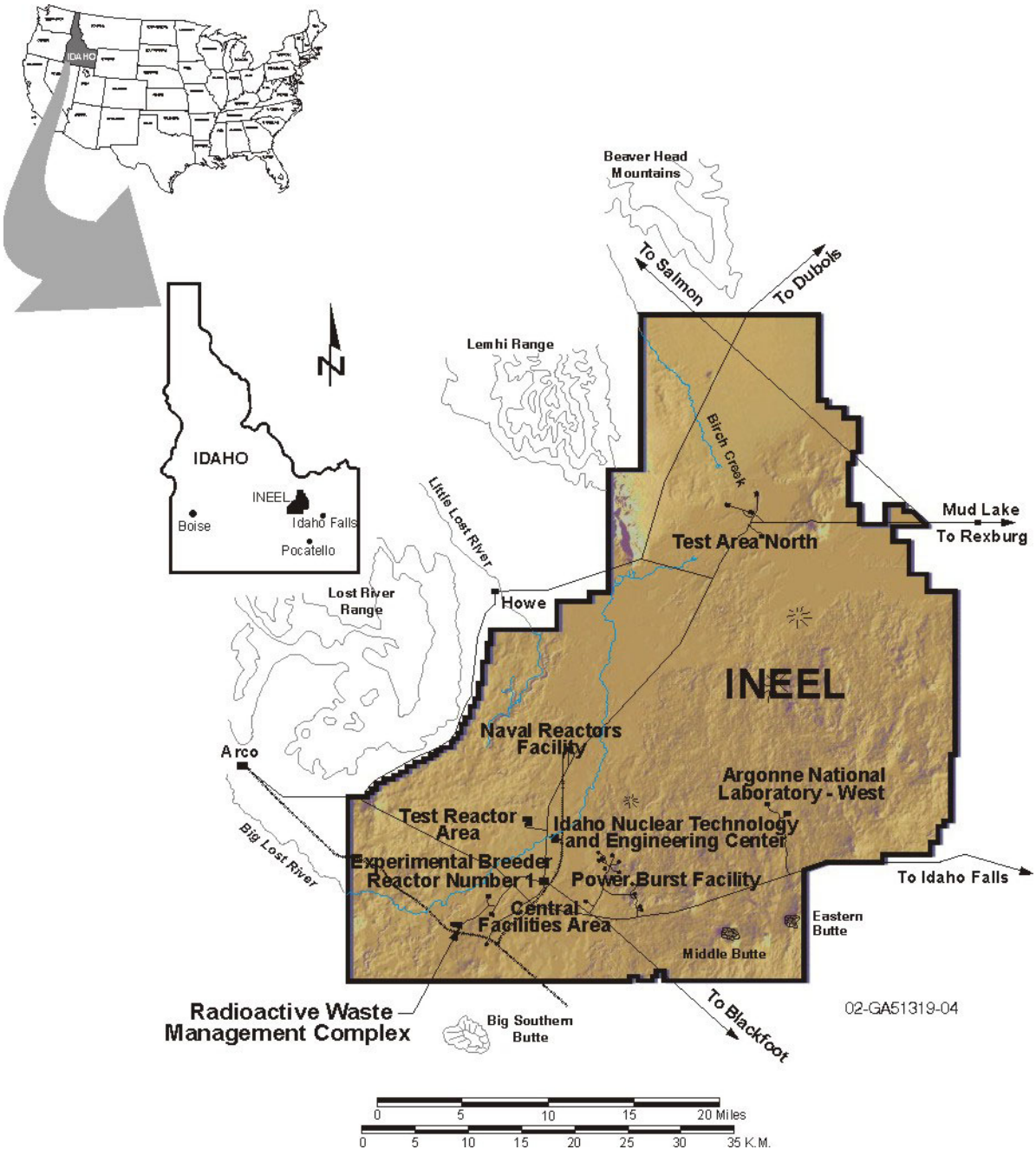

Figure 1-1. Map showing the location of the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory.

1.4 History of the Radioactive Waste Management Complex

The U.S. Atomic Energy Commission initially established the Site in 1949 as the National Reactor Testing Station for nuclear energy research and related activities. In 1952, the Site expanded its function and began accepting shipments of transuranic (TRU) radionuclides and low-level radioactive waste (LLW). In 1974, it was redesignated the Idaho National Engineering Laboratory, and then in 1997, to reflect the expansion of its mission to include a broader range of engineering and environmental management activities, the name was changed to INEEL. Currently, the INEEL is used to support the engineering efforts and operations of the DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology and conservation programs. The U.S. Department of Energy Idaho Operations Office has responsibility for the INEEL and delegates authority to operate the INEEL to government contractors. Bechtel BWXT Idaho, LLC, is the current management and operating contractor for the INEEL.

The RWMC was established in the early 1950s as a disposal site for solid LLW generated by operations at the INEEL and other DOE laboratories. Radioactive waste materials were buried in underground pits, trenches, soil vault rows, and one aboveground pad (Pad A) at the SDA. Transuranic waste is kept in interim storage in containers on asphalt pads at the Transuranic Storage Area. Radioactive waste from the INEEL was disposed of in the SDA starting in 1952. Rocky Flats Plant (RFP)[a] TRU waste was disposed of in the SDA from 1954 to 1970. Post-1970 TRU waste is kept in interim storage in containers on asphalt pads at the Transuranic Storage Area.

In August 1987, in accordance with the Resource Conservation and Recovery Act (42 USC § 6901 et seq., 1976), the DOE and the U.S. Environmental Protection Agency (EPA) entered into a *Consent Order and Compliance Agreement* (DOE-ID 1987). The *Consent Order and Compliance Agreement* required DOE to conduct an initial assessment and screening of all solid and hazardous waste disposal units at the INEEL and set up a process for conducting any necessary corrective actions. On July 14, 1989, the EPA (under the authority granted to them by the Comprehensive Environmental Response, Compensation and Liability Act [CERCLA] [42 USC § 9601 et seq., 1980], as amended by the Superfund Amendments and Reauthorization Act [Public Law 99-499, 1986]) proposed that the INEEL be listed on the National Priorities List (54 FR 29820, 1989). The final rule that listed the INEEL on the National Priorities List was published on November 21, 1989 (54 FR 48184, 1989). On December 4, 1991, because of the INEEL's listing on the National Priorities List, DOE, EPA, and the Idaho Department of Health and Welfare entered into the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991). The Federal Facility Agreement and Consent Order established the procedural framework and schedule for developing, prioritizing, implementing, and monitoring response actions at the INEEL in accordance with CERCLA, Resource Conservation and Recovery Act, and the Idaho Hazardous Waste Management Act (Idaho Code § 39-4401 et seq., 1983).

1.5 Accelerated Retrieval Project Overview

Commitments of DOE to the State of Idaho and the EPA contain enforceable deadlines that require analyzing the need to remediate buried TRU waste at the INEEL. The TRU waste is a result of INEEL support for the nuclear energy mission of the United States, both as a research laboratory and a waste management facility.

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a. The RFP, located 26 km (16 mi) northwest of Denver, Colorado, was renamed the Rocky Flats Environmental Technology Site in the mid-1990s. In the late 1990s, it was again renamed to its present name, the RFP Closure Project.

Waste buried at the SDA presents a potential risk to the Snake River Plain Aquifer from subsurface vapor-phase and aqueous transport of contaminants. For this reason, the U.S. Department of Energy Idaho Operations Office has elected to retrieve waste from selected high-density areas containing buried TRU waste under the CERCLA National Contingency Plan non-time-critical removal action process.

The selection of the described area within Pit 4 as the initial retrieval area was based on evaluation of the shipping and burial records of containerized radioactive materials and sludges from RFP and LLW generated at the INEEL. The information from this evaluation was used to identify several 1/2-acre areas within the SDA that contain relatively large amounts of TRU and other target wastes. The described area within Pit 4 (Figure 1-2) was selected for the initial waste retrieval in the SDA.

Waste removal objectives for the described area within Pit 4 are defined in the *Engineering Evaluation/Cost Analysis for the Accelerated Retrieval of a Designated Portion of Pit 4* (DOE/NE-ID-11146, Rev.0). The removal objective is to retrieve RFP targeted waste streams that are highly contaminated with transuranic radionuclides, volatile organic compounds (VOCs), and various uranium isotopes. To achieve the targeted waste retrieval, the project will focus on removal of Series 741 sludge, Series 743 sludge, graphite waste, filters, and roaster oxides. A brief description of these targeted wastes is provided below. A more detailed description of the project's targeted waste retrieval approach is provided in the *Excavation Plan and Sequential Process Narrative for the Accelerated Retrieval Project for a Described Area within Pit 4* (ICP/EXT-04-00283).

1. Series 741 sludge: The Series 741 sludge contains plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents. The 741 sludges are TRU targeted wastes.

2. Series 743 sludge: The Series 743 sludge is primarily composed of organic sludge containing high concentrations of volatile organic compounds including carbon tetrachloride, trichloroethene, tetrachloroethene, 1,1,1-trichloroethane, methylene chloride, and chloroform. The 743 sludges are VOC targeted waste.

3. Graphite: Graphite wastes were generated from mold and crucible pieces that were scraped to remove excess plutonium, then broken into small pieces. The graphite waste is a TRU targeted waste form.

4. Filters: The filter materials consist primarily of high efficiency particulate air (HEPA) filters from ventilation intake and exhaust filter plenums. The filter material is a TRU targeted waste form.

5. Roaster Oxide: Roaster Oxide waste is produced by the thermal stabilization (self-sustained combustion) of chips produced during the machining of uranium metal. Roaster oxide waste is defined as depleted uranium oxide and is composed primarily of U-238 isotope. The roaster oxide waste form is a uranium targeted waste.

Non-targeted waste types will be either left in the pit or returned to the pit. These include wastes that do not contain a high percentage of transuranic contaminants, VOCs, or uranium as determined by visual screening or other techniques implemented by the project. Based on the historical waste data for the described area within Pit 4, these waste forms include Series 742 sludge, Series 744 sludge, non-RFP sludge, combustibles including mixed debris, and noncombustibles.

1.5.1 Accelerated Retrieval Project Facilities

The Accelerated Retrieval Project facilities include a Retrieval Enclosure and two attached airlock structures, a Storage Enclosure, and support facilities (Figure 1-2). These facilities are described in more detail in the following sections.

1.5.1.1 Accelerated Retrieval Project Retrieval Enclosure. The Retrieval Enclosure and attached airlocks are temporary structures that will house waste retrieval, sorting, sampling, and packaging activities. The Retrieval Enclosure provides weather protection and year-round operations for these activities. The Retrieval Enclosure is a commercially available, fabric-tensioned structure, approximately 51.8 m (170 ft) wide by 87.8 m (288 ft) long with a 6.1-m-minimum (20-ft-minimum) interior clearance at the eaves. It has sufficient space and interior height to house excavator operations and waste-container movements. Two attached 21.3 × 15.2-m (70 × 50-ft) structures house the airlock operations.

Ventilation is provided by a HEPA-filtered exhaust system. The exhaust stack is designed to minimize local worker exposure and permit proper radiological emissions monitoring configuration. The ventilation system is equipped with an emissions monitoring system to sample and record possible releases of radioactive substances.

A direct-fired heating system will be used to heat the Retrieval Enclosure. The direct-fired heaters minimize potential for propane to enter the facility because of the high burn efficiency of the units. The heater is equipped with a spark-ignited intermittent pilot and a single-stage, 24-V gas valve.

The Retrieval Enclosure will be provided with electricity for auxiliary equipment and small loads as required. Because of the mobile nature of the Retrieval Enclosure, extensive use will be made of flexible cords and cables as opposed to conductors in conduit. Lighting in the Retrieval Enclosure is both fixed position and mobile for adjusting to the excavation process. Fixed lighting will be positioned to provide personnel adequate lighting to safely walk inside the retrieval facility. Additional mobile lighting will be positioned and repositioned to support the excavation activities as it progresses.

1.5.1.2 Retrieval Enclosure Airlocks. The two airlock structures attached to the south side of the retrieval enclosure provide controlled areas to perform work without entering the more contaminated area inside the retrieval enclosure. The airlocks are 21.3 × 15.2-m (70 × 50-ft) and are equipped with an air-handling units providing approximately 2,000 cfm of air to each airlock. This positive airflow into each airlock ensures the airflow from the airlocks into the retrieval enclosure during operations in case of a loss of primary facility ventilation. The airlocks will have heating and air conditioning to maintain adequate working temperatures for personnel.

1.5.1.2.1 Retrieval Enclosure Airlock One—Retrieval enclosure airlock one provides a telehandler service bay, excavator service bay, and personnel access airlocks. The telehandler forklift and excavator will be parked in the respective bay when not in use inside the retrieval enclosure. Personnel can enter either service bay through the personnel access airlock located between the two service bays. The purpose of airlock one is to provide an area where personnel can perform routine operations including recharging the breathing air systems, fueling the equipment, refilling the soil surfactant reservoir on the excavator, decontaminating equipment, inspection and maintenance activities, and entering/exiting the equipment while located in a less contaminated and more controlled work area separated from the retrieval enclosure.

1.5.1.2.2 Retrieval Enclosure Airlock Two—Retrieval enclosure airlock two provides a work area for processing waste zone material through drum packaging stations to separate

personnel from the Retrieval Enclosure. Personnel working inside airlock two will utilize the six drum packaging stations located inside airlock two to inspect, sample, and package waste materials. The drum packaging stations are equipped with a lower level where personnel will process waste using gloveports, and an upper platform area where the waste liners will be placed into drums using a hoist located inside the drum packaging station.

1.5.1.3 Storage Enclosure. The Storage Enclosure is a temporary structure that provides indoor storage and staging of packaged waste. The Storage Enclosure is a commercially available, standard, fabric-tensioned structure, approximately 39.6 m (130 ft) wide by 48.8 m (160 ft) long with 6.1-m-minimum (20-ft-minimum) interior clearance at the eaves. The Storage Enclosure is constructed of a prefabricated metal frame covered with an outer PVC-coated polyester fabric membrane. The interior floor consists of a concrete pad.. Mechanical and electrical equipment supporting the Storage Enclosure is housed external to the enclosure. The Storage Enclosure is not heated but may be ventilated to minimize accumulation of volatile organic compounds, if required.

1.5.1.4 Operational Support Facilities. Operational support facilities include a mobile fissile material assay unit(s), breathing air unit(s), sample support unit, and operations support trailers. The support facilities support operations, including providing a general work area, a viewing area with monitors for visual observation, minimal lab capabilities, PPE changeout, storage, and utility housings. These facilities are positioned near the Retrieval Enclosure and used by operations to support the activities performed onsite in the SDA and within the Retrieval Enclosure.

1.5.2 Accelerated Retrieval Project Construction

The Accelerated Retrieval Project construction activities include site development and utilities work, retrieval enclosure and airlock installation, operational support facilities installation, and Storage Enclosure installation.

1.5.2.1 Site Development and Utilities. The Accelerated Retrieval Project location is prepared during this phase for future construction and operational activities of the Accelerated Retrieval Project. The site development work includes the removal of overburden in the area of the Retrieval Enclosure. The overburden is removed and staged in a designated area of the SDA for later possible return to the pit. The site utilities, building pads, power, communications lines, and other support utilities are prepared or installed during this phase of work.

1.5.2.2 Retrieval Enclosure and Airlock Installation. The Retrieval Enclosure and airlock structures will be installed in the selected project area over Pit 4 where the overburden was previously removed. Retrieval Enclosure construction includes installation and securing of the prefabricated metal frame and covering the frame with the fabric membrane. The airlock structure is constructed to abut with the Retrieval Enclosure. All government-furnished equipment, power, and communication equipment is installed or connected.

1.5.2.3 Storage Enclosure. The Storage Enclosure will be installed and all support connections completed for operation. The Storage Enclosure will be constructed on a concrete pad. The mechanical and electrical equipment supporting the Storage Enclosure is located next to the Storage Enclosure facility.

1.5.3 Accelerated Retrieval Project Operations

The Accelerated Retrieval Project provides a cost-effective method of retrieving and managing SDA waste material, while maintaining protection of the workers, public health, and the environment.

The basic concept comprises waste retrieval in the Retrieval Enclosure, transfer of waste containers into the airlock for processing, assay of the waste containers after release from the airlock, and interim storage in a Storage Enclosure in the SDA. Other processes necessary for the safe handling and processing of the waste and waste containers will be performed as determined necessary by the project. The following section describes the process in greater detail.

1.5.3.1 Accelerated Retrieval Project Waste Retrieval and Handling Operations. An equipment operator in PPE will operate an excavator to retrieve waste material from a described area within Pit 4 (see Figure 1-2) and place it into a designed tray equipped with a liner. Another operator in PPE will operate a forklift to transport the waste trays to and from the drum packaging stations, to return nontargeted waste back to the pit, and perform other required material handling tasks inside the Retrieval Enclosure. The excavator and telehandler forklift cabs are equipped with a breathing air system and a HEPA-filtered forced-air blower system providing a positive pressure inside the cabs. Personnel access to the Retrieval Enclosure will be limited during excavation activities, but other individuals in PPE may be allowed inside the Retrieval Enclosure when no waste handling activities are being performed, such as radiological control technicians (RCTs), ARP operators, and maintenance personnel.

The waste-zone material is retrieved using the excavator, which is operated above grade. The pit is expected to be approximately 6.1–8.5 m (20–28 ft) deep, and the walls will be sloped to maintain an angle of repose of approximately 1 to 1 for surface stability. Personnel, and equipment operated by personnel, will not enter the excavation pit without first evaluating the pit for sloping, stability, and other safety considerations in accordance with PRD-22, "Excavation and Surface Penetration."

At the digface, the excavator operator retrieves targeted waste (e.g., graphites, filters, Series 741 and 743 sludge, and uranium) and places the waste in a tray with a plastic liner. The targeted/nontargeted waste determination is made by visual exam personnel assisting the excavator operator by way of closed-circuit television cameras at the digface and mounted on the excavator. Nontargeted waste (e.g., debris, soil, and Series 742 and 744 sludge) is returned to the excavation. The trays of targeted waste will be transported to a drum packaging station by the forklift.

At the drum packaging station, visual examinerswill assign a Waste Isolation Pilot Plant (WIPP) summary category group number to the tray of waste, sample as necessary, and remove any WIPP-prohibited items. The tray liner will then be hoisted and loaded into a drum. The waste material may be counted using a fissile material monitor, if the waste contains graphites or filters, for criticality safety. The loaded drum is then removed from the area and transported to a fissile material assay system to ensure safe storage. Each waste drum will be assayed to verify that the fissile gram loading is less than 380 fissile gram equivalent (FGE). Drums less than 380 FGE will be transported to the storage enclosure for routine storage, while drums greater than 380 FGE will require special precautions and storage requirements for criticality safety.

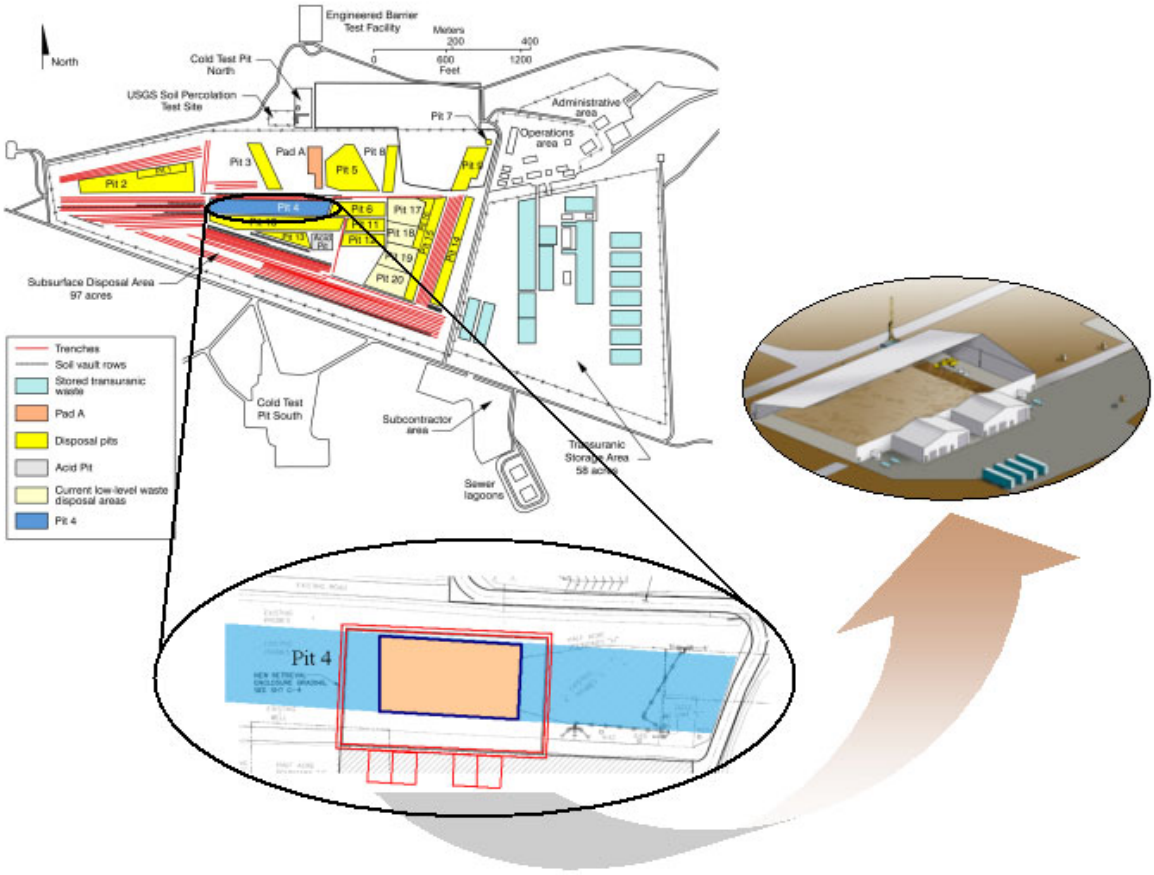


Figure 1-2. Map showing the described area within Pit 4 for the Accelerated Retrieval Project.

2. HAZARD IDENTIFICATION AND MITIGATION

Construction and operation of the Accelerated Retrieval Project facilities presents physical, chemical, and radiological hazards to personnel. Identification and mitigation of these hazards is imperative to prevent injury or exposure to personnel conducting these activities. The primary objective of this section is to identify existing and anticipated hazards based on project operations and to provide controls to eliminate or mitigate these hazards, which include the following:

- Evaluation of project operational tasks to determine the extent that potential industrial safety, radiological, nonradiological, and physical hazards may affect facility personnel

- Establishment of the necessary monitoring and sampling required to evaluate exposure and contamination levels, determine action levels to prevent exposures, and provide specific actions to be followed if action levels are reached

- Determination of necessary engineering controls, isolation methods, administrative controls, work practices, and (where these measures will not adequately control hazards) PPE to further protect project personnel from hazards.

The purpose of this hazard identification section is to lead the user to an understanding of the occupational safety and health hazards associated with project operational tasks. This will enable project management and safety and health professionals to make effective and efficient decisions related to the equipment, processes, procedures, and the allocation of resources to protect the safety and health of project personnel.

The magnitude of danger presented by the project hazards to personnel conducting project operations in the Retrieval Enclosure is dependent on both the nature of tasks being performed and the proximity of personnel to the hazardous materials and operations. Engineering controls have been implemented along with administrative controls, work procedures, and PPE to further mitigate potential exposures and hazards.

The following section describes the chemical, radiological, safety, and environmental hazards that personnel may encounter while conducting project operational activities. Hazard mitigation will be implemented through a combination of designed engineering controls with other work controls (e.g., TPRs, work orders, JSAs, safe work permits [SWPs], and radiological work permits [RWPs]). This hazard mitigation strategy will be used to eliminate or mitigate project hazards in accordance with "Activity Level Hazard Identification, Analysis, and Control" (PRD-25) to the extent possible.

2.1 Chemical and Radiological Hazards and Mitigation

Personnel may be exposed to industrial safety hazards or to radiological, nonradiological, and physical agents while conducting project operations. Designed engineering controls will be implemented along with work procedures, real-time monitoring of contaminants, and project facility-specific hazard training to further mitigate potential hazards and exposures. Formal preplanning (e.g., job walk-down, completion of the hazard profile screening checklists, and prejob briefing checklists), JSAs, and other work controls will be written utilizing the hazards identified in this HASP, TPRs, "Integrated Work Control Process" (STD-101), work packages, and operational conditions. These documents will specify specific operational hazard mitigation measures to follow.

2.1.1 Radiological Material Inventory

The radioactive material inventory in the SDA is discussed in the "Preliminary Safety Analysis Report for the Accelerated Retrieval Project for a Described Area within Pit 4" (SAR-215) and a final version of "SDA Inventory Evaluation for ISG, ISV, and ISTD PDSA Source Terms" (EDF-3543). Some uncertainties about the radioactive material inventory exist. Therefore, several sources of information were used in the engineering design file to determine the most conservative average and bounding inventories. These include an evaluation of shipping records, nondestructive examination data on aboveground waste, inventory database evaluation, SDA probe data, and sample data at the RFP. The uncertainty in waste shipping records, process knowledge, and calculation methods precludes determining exact quantities; however, these estimates are the result of careful analysis and the best professional judgment.

Rather than develop SDA pit or trench specific inventories, the engineering design file develops representative radioactive and nonradioactive material inventories per drum and areal-drum densities at the SDA. The engineering design file addresses all waste types buried in the SDA, including TRU waste, contact-handled LLW, and remote-handled LLW. It also addresses nonradioactive hazardous materials that are part of the mixed TRU and LLW waste. The areas analyzed include the closed pits (Pits 1–16), the open pits (Pits 17–20), all trenches (Trenches 1–58), and all soil vault rows (Rows 1–21). While the engineering design file addresses areas of the SDA that will not be excavated, it represents bounding inventories for the project.

Using the methodology of "SDA Inventory Evaluation for ISG, ISV, and ISTD PDSA Source Terms" (EDF-3543) for determining large-area TRU inventories, the inventory for the Accelerated Retrieval Project is estimated to be approximately 23,197.9 Ci of Pu-239 equivalents. This inventory includes trench data but is considered representative of the SDA pits. The excavation area is assumed to be 33.5 × 61.6 m (6772.7 m^2) (110 × 202 ft [22,220 ft^2]). The estimated TRU inventory is derived in Table 2-1.

Table 2-1. Estimated transuranic inventories for the Accelerated Retrieval Project.

Estimated transuranic inventory	=	Impacted area × median transuranic drum areal density × average drum content = 22,220 ft^2 × 0.29 drums/ft^2 × 3.6 Ci/drum = 23,197.9 Ci of Pu-239 equivalents

The "SDA Inventory Evaluation for ISG, ISV, and ISTD PDSA Source Terms" (EDF-3543) also provides a methodology for determining large-area LLW inventories in the SDA. The estimated LLW inventories for significant LLW isotopes (based on inventory and inhalation hazard) are provided in Table 2-2. The majority of these inventories are found in the SDA trenches but are considered bounding for the project.

Table 2-2. Estimated low-level waste inventory in excavation area.

Isotope	Best Estimate Average Inventory (Ci/ft^2)	Affected Area (ft^2)	Average Inventory for Excavation (Ci)
Co-60	1.80E+00	22,220	4.00E+04
Fe-55	3.30E+00	22,220	7.33E+04
Cr-51	6.40E–01	22,220	1.42E+04
H-3	1.20E+00	22,220	2.67E+04
Ni-63	1.10E+00	22,220	2.44E+04
Co-58	3.00E–01	22,220	6.67E+03
Mn-54	2.50E–01	22,220	5.56E+03
Sr-90	5.30E–01	22,220	1.18E+04
Cs-137	5.10E–01	22,220	1.13E+04
Ce-144	1.20E–01	22,220	2.67E+03

2.1.2 Nonradiological Inventory

The chemical inventory in the SDA is developed in "SDA Inventory Evaluation for ISG, ISV, and ISTD PDSA Source Terms" (EDF-3543) and summarized in the "Preliminary Safety Analysis Report for the Accelerated Retrieval Project for a Described Area within Pit 4" (SAR-215). The EDF-3543 also provides a methodology that can be used to determine the chemical inventory for this project. While the engineering design file addresses areas of the SDA that will not be excavated as part of this project, it represents bounding inventories for the project. The uncertainty in waste shipping records, process knowledge, and calculation methods precludes determining exact quantities; however, these estimates are the result of careful analysis and the best professional judgment. The SDA nonradiological hazardous inventory and the project inventory for a 33.5 × 61.6-m (110 × 202-ft) excavation are estimated in Table 2-3.

A number of nonradioactive hazardous materials in the SDA are present in trace amounts, of which presence or location cannot be verified or of which quantities are unknown. These materials include picric acid, at least two 25-lb packs of sodium or potassium cyanide, lithium oxide from RFP battery waste, nitrobenzene, and polychlorinated biphenyls (Einerson and Thomas 1999).

Nitrocellulose is a fire and explosion hazard. An analysis has been performed on the likelihood of explosive quantities of nitrocellulose present in the SDA and the likelihood of nitrocellulose formation in the SDA. This analysis concluded that the likelihood of a nitrocellulose explosion or the formation of nitrocellulose in the SDA is highly improbable (Einerson and Thomas 1999).

Table 2-3. Nonradiological hazardous materials inventory for Subsurface Disposal Area and estimated for the Accelerated Retrieval Project excavation size.

Chemical	Chemical Abstract System #	Average Subsurface Disposal Area Density (g/ft^2)	Excavation Area (ft^2)	Average Inventory (g)
1,1,1-trichloroethane	71-55-6	1.70E+02	22,220	3.78E+06
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1	1.30E+01	22,220	2.89E+05
2-butanone	78-93-3	5.60E–02	22,220	1.24E+03
Acetone	67-64-1	1.80E–01	22,220	4.00E+03
Aluminum nitrate nonahydrate	7784-27-2	3.40E+02	22,220	7.55E+06
Ammonia	7664-41-7	2.50E+00	22,220	5.56E+04
Anthracene	120-12-7	6.50E–04	22,220	1.44E+01
Antimony	7440-36-0	1.40E–03	22,220	3.11E+01
Aqua regia	NA	4.50E–05	22,220	1.00E+00
Arsenic	7440-38-2	1.60E–06	22,220	3.56E–02
Asbestos	1332-21-4	6.70E+00	22,220	1.49E+05
Barium	7440-39-3	1.70E–05	22,220	3.78E–01
Benzine	8032-32-4	6.70E–03	22,220	1.49E+02
Beryllium	7440-41-7	1.00E+02	22,220	2.22E+06
Butyl alcohol	71-36-3	1.50E–01	22,220	3.33E+03
Cadmium	7440-43-9	3.20E+00	22,220	7.11E+04
Carbon tetrachloride	56-23-5	1.20E+03	22,220	2.67E+07
Cerium chloride	7790-86-5	8.70E–01	22,220	1.93E+04
Chloroform	67-66-3	5.20E–05	22,220	1.16E+00
Chromium	7440-47-3	2.20E–03	22,220	4.89E+01
Copper	7440-50-8	6.30E–02	22,220	1.40E+03
Copper nitrate	3251-23-8	5.80E–04	22,220	1.29E+01
Ethyl alcohol	64-17-5	3.90E–02	22,220	8.67E+02
Formaldehyde	50-00-0	2.10E–01	22,220	4.67E+03
Hydrazine	302-01-2	3.20E–03	22,220	7.11E+01
Hydrofluoric acid	7664-39-3	1.30E+01	22,220	2.89E+05
Lead	7439-92-1	1.10E+03	22,220	2.44E+07
Magnesium	7439-95-4	1.50E+01	22,220	3.33E+05
Magnesium fluoride	7783-40-6	2.00E–01	22,220	4.44E+03
Mercury	7439-97-6	2.70E+00	22,220	6.00E+04
Mercury nitrate monohydrate	10045-94-0	1.40E+00	22,220	3.11E+04
Methyl alcohol	67-56-1	3.50E–01	22,220	7.78E+03
Methyl isobutyl ketone	108-10-1	1.50E+01	22,220	3.33E+05

Table 2-3. (continued).

Chemical	Chemical Abstract System #	Average Subsurface Disposal Area Density (g/ft^2)	Excavation Area (ft^2)	Average Inventory (g)
Methylene chloride	75-09-2	2.10E+01	22,220	4.67E+05
Nickel	7440-02-0	5.80E–03	22,220	1.29E+02
Nitric acid	7697-37-2	8.60E+01	22,220	1.91E+06
Potassium chloride	7447-40-7	1.30E+02	22,220	2.89E+06
Potassium cyanide	151-50-8	2.70E–03	22,220	6.00E+01
Potassium dichromate	7778-50-9	4.20E+00	22,220	9.33E+04
Potassium nitrate	7757-79-1	3.40E+03	22,220	7.55E+07
Potassium phosphate	7778-77-0	1.80E+01	22,220	4.00E+05
Potassium sulfate	7778-80-5	1.30E+02	22,220	2.89E+06
Silver	7440-22-4	1.00E–02	22,220	2.22E+02
Sodium	7440-23-5	1.10E–01	22,220	2.44E+03
Sodium chloride	7647-14-5	2.50E+02	22,220	5.56E+06
Sodium cyanide	143-33-9	2.70E–03	22,220	6.00E+01
Sodium dichromate	0588-01-9	7.60E+00	22,220	1.69E+05
Sodium hydroxide	1310-73-2	4.80E–04	22,220	1.07E+01
Sodium nitrate	7631-99-4	6.50E+03	22,220	1.44E+08
Sodium phosphate	10101-89-0	3.80E+01	22,220	8.44E+05
Sodium potassium	11135-81-2	3.20E+00	22,220	7.11E+04
Sodium sulfate	7757-82-6	2.90E+02	22,220	6.44E+06
Sulfuric acid	7664-93-9	2.10E–01	22,220	4.67E+03
Terphenyl	26140-60-3	1.40E+00	22,220	3.11E+04
Tetrachloroethylene	127-18-4	1.40E+02	22,220	3.11E+06
Toluene	108-88-3	3.50E–01	22,220	7.78E+03
Tributyl phosphate	126-73-8	1.80E+00	22,220	4.00E+04
Trichloroethylene	79-01-6	1.70E+02	22,220	3.78E+06
Trimethylolpropane-triester	15625-89-5	2.20E+00	22,220	4.89E+04
Uranium	NA	7.60E+02	22,220	1.69E+07
Uranyl nitrate	36478-76-9	3.90E–01	22,220	8.67E+03
Versenes (EDTA)	NA	3.10E+01	22,220	6.89E+05
Xylene	1330-20-7	1.40E+00	22,220	3.11E+04
Zirconium	7440-67-7	3.20E+01	22,220	7.11E+05
Zirconium alloys	NA	1.00E+01	22,220	2.22E+05
Zirconium oxide	NA	7.40E–03	22,220	1.64E+02

NA = not assigned

2.1.3 Routes of Exposure

Exposure pathways exist for radiological and nonradiological contaminants that will be encountered during project operations. Engineering controls, monitoring, training, and work controls will mitigate potential contact and uptake of these hazards. The following list includes exposure pathways:

- **Inhalation** of radiological and nonradiological contaminated soil or fugitive dust during overburden excavation, waste handling and sorting, packaging, or decontamination tasks. Inhalable or respirable (dependent on the particle aerodynamic diameter) fugitive dust may have trace amounts of radiological or nonradiological contaminants associated with it, resulting in potential respiratory tract deposition.

- **Skin absorption and contact** with radiological and nonradiological contaminated soil or surfaces during overburden excavation, waste handling and sorting, packaging, decontamination, or system maintenance tasks. Radiological and nonradiological contaminants can be absorbed through broken skin or by solvent action, resulting in uptake, and skin contamination or irritation.

- **Ingestion** of radiological and nonradiological contaminated soil or materials adsorbed to fugitive dust particles or waste residues, resulting in potential uptake of contaminants into the upper respiratory tract or directly through the gastrointestinal tract (placing contaminated surfaces in mouth) that may result in gastrointestinal irritation, internal tissue irradiation, or deposition to target organs.

- **Injection** of radiological and nonradiological contaminated materials by breaking of the skin or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

An evaluation of the chemicals, the warning signs and symptoms of exposure, and exposure limits for each agent that may be potentially encountered in the SDA is provided in Table 2-4. Chemical and radiological hazards will be eliminated, isolated, or mitigated to the extent possible during all project construction and operations. Where these hazards cannot be eliminated or isolated through engineering controls, monitoring for chemical and radiological hazards will be conducted (as described in Section 3) to detect and quantify exposures. Additionally, administrative controls, training, work procedures, and protective equipment will be used to further reduce the likelihood of exposure to these hazards through the routes of entry listed above. Table 2-5 summarizes each primary construction and operational activity, associated hazards, and mitigation procedures.

The RWPs, JSAs, TPRs, and work orders will be used, and SWPs may be used in conjunction with this HASP to provide task- or activity-specific requirements for project activities. When used, these documents will further detail specialized PPE and dosimetry requirements.

Table 2-4. Evaluation of chemicals and potential contaminants of concern that may be encountered.

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Acetone (67-64-1) IE = 9.7 eV	TWA: 500 ppm STEL: 750 ppm	Ih, Ig, Con	Irritation to eyes, nose, and throat; headache; dizziness; dermatitis; central nervous system depression	Eyes, skin, respiratory system, central nervous system	Yes – A4 – ACGIH
Ammonia (7664-41-7) IE = 10.18 eV	TWA: 25 ppm STEL: 35 ppm	Ih, Ig, Con	Irritation to eyes, nose, and throat; despondent; bronchial spasms; chest pain; pulmonary edema; pink/frothy sputum; skin burns	Eyes, skin, respiratory system	No
Anthracene (120-12-7)	TWA: 0.2 mg/m^3	Ih, Con	Dermatitis, bronchitis	Respiratory system, eyes, skin, bladder, kidneys	Yes – A1 – ACGIH
Antimony (7440-36-0)	TWA: 0.5 mg/m^3	Ih, Ig, Con	Irritation to eyes, nose, mouth, and throat; cough; headache; nausea; diarrhea; stomach ache; insomnia; anorexia; unable to smell correctly; dizziness	Eyes, skin, respiratory system, cardiovascular system	No
Arsenic (inorganic compounds, as As) (7440-38-2)	TWA: 0.01 mg/m^3	Ih, Abs, Con, Ig	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, respiratory irritation, hyperpigmentation	Liver, kidneys, skin, lungs, lymphatic system	Yes – A1 – ACGIH Ca-OSHA 1-IARC
Asbestos (12001-29-5)	TWA: : 0.1 fiber/cc Excursion limit: 1 fiber/cc in 30 minutes (29 CFR 1926.1101)	Ih, Ig, Con	Irritation of eyes and skin, chronic asbestosis, restricted pulmonary function	Eyes, respiratory tract, lung lining	Yes - A1 – ACGIH 1– IARC Ca – OSHA
Ascorbic acid (50-81-7)	None established	Ih, Ig	Eye irritation	Mild irritation of eyes only	No
Barium (7440-39-3)	TWA: 0.5 mg/m^3	Ih, Ig, Con	Irritation of eyes, mucous, and skin; muscle and gastrointestinal cramps	Skin, eyes	Yes – A4 – ACGIH

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Benzine (8032-32-4)	TWA: 350 mg/m^3 Ceiling: 1,800 mg/m^3	Ih, Ig, Con	Irritation of eyes, upper respiratory system, dermatitis, central nervous system depression, chemical pneumonia	Eyes, skin, respiratory system, central nervous system	No
Beryllium (7440-41-7)	TWA: 0.002 mg/m^3 STEL: 0.01 mg/m^3	Ih, Con	Berylliosis, anorexia, weight loss, weakness, chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency, irritation eyes, dermatitis	Eyes, skin, respiratory system	Yes – 1-IARC Ca-NIOSH A1-ACGIH
2-butanone (78-93-3) IE = 9.5 eV	TWA: 200 ppm STEL: 300 ppm.	Ih, Ig, Con	Eye irritation, skin irritation, nose irritation, headache, dizziness, vomiting, dermatitis	Eyes, skin, respiratory system, central nervous system	No
Butyl alcohol (71-36-3) IE = 9.7 eV	TWA: 20 ppm	Ih, Ig, Con	Irritation of eyes, skin, nose, and throat; drowsiness; narcosis	Eyes, skin, respiratory system, central nervous system	No
Cadmium (7440-43-9)	TLV: 0.01 mg/m^3 Respirable: 0.002 mg/m^3 PEL: 5 µg/m^3 Action level: 2.5 µg/m^3 (29 CFR 1926.1127)	Ih, Ig	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, anosmia, emphysema, proteinuria, mild anemia	Respiratory system, kidneys, prostate, blood	Yes – 1-IARC A2 – ACGIH Ca – OSHA
Carbon tetrachloride (56-23-5) IE-=11.5 eV	TWA: 5 ppm STEL: 10 ppm Ceiling: 25 ppm	Ih, Ig, Con	Irritation of eyes and skin, central nervous system depression, nausea, vomiting, liver, kidney injury, drowsiness, dizziness, uncoordination, (potential occupational carcinogen)	Central nervous system, eyes, lungs, liver, kidneys, skin	Yes – Ca-NIOSH A2 – ACGIH 2B-IARC
Chloroform (67-66-3) IE = 11.4 eV	TWA: 10 ppm	Ih, Ig, Con	Irritation of eyes and skin, dizziness, mental dullness, nausea, confusion, headache, lassitude (weakness, exhaustion), anesthesia, enlarged liver, (potential occupational carcinogen)	Liver, kidneys, heart, eyes, skin, central nervous system	Yes – 2B-IARC A3-ACGIH Ca-NIOSH

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Chromium (as Cr) (7440-47-3)	TWA: CrIII: 0.5 mg/m^3 CrIV: 0.05 mg/m^3 CrVI: 0.01 mg/m^3	Ih, Ig, Con	Irritation of eyes, sensitization, dermatitis	Eyes, skin	Yes – Ca-NIOSH A4 and A1 – ACGIH 1-IARC
Copper (dust) (7440-50-8)	TWA: 1 mg/m^3	Ih, Ig, Con	Irritation of eyes, upper respiratory system, metal fume fever, chills, muscle ache, nausea, fever, dry throat, cough, weakness, metallic taste, discoloration of skin and hair	Eyes, skin, respiratory system, liver, kidneys	No
Diesel fuel (68476-34-6) IE = N/A	TWA: 100 mg/m^3 (ACGIH—diesel fuel vapor or aerosol)	Ih, Ig, Con	Eye irritation, respiratory system changes, dermatitis	Eye, respiratory system	Yes – 2B-IARC A3-ACGIH
Diesel exhaust (particulate aerodynamic diameter <1 μm)	TWA: 0.02 mg/m^3 (ACGIH 2002)	Ih	Respiratory, nose, throat, or lung irritation with stinging and redness of the eyes; headache; nausea; dizziness; unconsciousness	Respiratory system	Yes - A2 – ACGIH Ca-NIOSH 2A-IARC
EDTA (tetrasodium) (64-02-8)	None established	Ig, Con	Eye, skin, and mucous membrane irritation	Eyes, skin	No
Ethyl alcohol (64-17-5) IE = 10.47 eV	TWA: 1,000 ppm	Ih, Ig, Con	Irritation of eyes, skin, and nose; headache; drowsiness; fatigue; narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eyes, skin, respiratory system, central nervous system, liver, blood, reproductive system	Yes – A4-ACGIH
Formaldehyde (50-00-0) IE = 10.9 eV	TWA: 0.75 ppm Ceiling: 0.3 ppm	Ih, Con	Irritation of eyes, nose, throat, and respiratory system; cough bronchial spasms	Eyes, respiratory system	Yes – A2 – ACGIH Ca-NIOSH 2A-IARC Ca-OSHA

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Freon 113 (76-13-1) IE = 11.99 eV	TWA: 1,000 ppm STEL: 1,250 ppm	Ih, Ig, Con	Irritation of skin and throat; drowsiness; dermatitis; central nervous system depressant and depression (in animals); cardiac arrhythmia; narcosis	Skin, heart, central nervous system, cardiovascular system	No
Hydrazine (302-01-2) IE = 8.9 eV	TWA: 0.01 ppm	Ih, Ig, Con, Abs	Irritation of skin, eyes, nose, and throat; temporary blindness; dizziness; nausea; dermatitis; burns	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Yes – A3 – ACGIH Ca-NIOSH 2B-IARC
Hydrofluoric Acid (7664-39-3) IE = 15.98 eV	TWA: 3 ppm Ceiling: 3 ppm	Ih, Abs, Ig, Con	Irritation of skin, eyes, nose, and throat; pulmonary edema; burns; rhinitis; bronchitis; bone changes	Eyes, skin, respiratory system, bones	No
Lead (7439-92-1)	TLV: 50 µg/m^3 **OR** A PEL in µg/m^3 equal to 400 divided by the number of hours worked per day for shifts longer than 8 hours (29 CFR 1926.62)	Ih, Ig, Con	Weakness, lassitude, insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, paralysis wrist, ankles, encephalopathy, kidney disease, irritation eyes, hypotension	Eyes, gastrointestinal, central nervous system, kidneys, blood, gingival tissue	Yes – 2B-IARC A3-ACGIH
Lithium oxide (12057-24-8)	None established	Ih, Ig, Con	Corrosive to eyes, skin, nose, and throat	Skin and eyes (corrosive)	No
Mercury (7439-97-6)	TWA: 0.025 mg/m^3—skin Ceiling: 0.1 mg/m^3	Ih, Ig, Con	Irritation of eyes and skin, cough, chest pain, dyspnea, bronchitis pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, gastrointestinal disturbance, anorexia, weight loss, proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	Yes – 3-IARC A4-ACGIH

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Methyl alcohol (67-56-1) IE = 10.84 eV	TWA: 200 ppm	Ih, Ig, Con	Eye, skin, nose, and throat irritation; headache; drowsiness; optic nerve atrophy; chest tightness; narcosis	Eyes, skin, respiratory system, central nervous system	No
Methyl isobutyl ketone (108-10-1) IE = 9.3 eV	TWA: 50 ppm STEL: 75 ppm	Ih, Ig, Con	Irritation of eyes, skin, and mucous membranes; headache; narcosis; coma; dermatitis	Eyes, skin, respiratory system, central nervous system, liver, kidneys	No
Methylene chloride (75-09-2) IE = 11.3 eV	TLV: 50 ppm OSHA (29 CFR 1910.1052). PEL: 25 ppm. STEL: 125 ppm	Ih, Ig, Con	Eye and skin irritation, fatigue, weakness, somnolence, lightheadedness, numbness, tingle limbs, nausea	Eyes, skin, cardiovascular system, central nervous system	Yes – Ca-NIOSH – A3 – ACGIH 2B-IARC Ca-OSHA
Nickel (elemental) (7440-02-0)	TWA: 1.5 mg/m^3	Ih, Ig, Con	Sensitization dermatitis, allergic asthma, pneuitis	Nasal cavity, lungs, skin	Yes – A5 – ACGIH 2B-IARC Ca-NIOSH
Nitric acid (7697-37-2) IE = 11.9 eV	TWA: 2 ppm STEL: 4 ppm	Ig, Con	Irritation of eyes, skin, and mucous membrane; pulmonary edema; pneuitis; bronchitis; dental erosion	Eyes, skin, respiratory system, teeth	No
Nitrobenzene (98-95-3) IE = 9.9 eV	TWA: 5 mg/m^3	Ih, Con, Ig	Anoxia; irritation eyes; dermatitis; anemia; liver and kidney damage in animals	Blood, liver, cardiovascular system, kidneys, skin	Yes – A3-ACGIH 2A-IARC
Picric Acid (88-89-1)	TWA: 0.1 mg/m^3	Ih, Con	Irritation eyes, dermatitis, yellow stained hair and skin, weakness, myalgia, anuria, hepatitis, bitter taste, GI disturbance, hematuria, albium, nephritus	Kidneys, liver, blood, skin, eyes	No

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Polychlorinated biphenyls not specified (Aroclor-1254 used for toxicological evaluation purposes)	TWA: 0.5 mg/m^3—skin	Ih, Ig, Con	Eye irritation, chloracne, liver damage, reproductive effects	Skin, eyes, liver, reproductive system	Yes – 2A-IARC
Potassium chloride (7447-40-7)	None established	Ih, Ig, Con	Eyes, irritation of mucous membranes	None identified, primarily a localized irritant	No
Potassium cyanide (151-50-8)	TWA: 5 mg/m^3	Ih, Ig, Con	Irritation of eyes, skin, and upper respiratory system; asphyxia; lassitude (weakness, exhaustion); headache; confusion; nausea; vomiting; increased respiratory rat; slow gasping respiration; thyroid; blood changes	Eyes, skin, respiratory system, cardiovascular system, central nervous system, thyroid, blood	No
Potassium dichromate (7778-50-9)	TWA: 0.05 mg/m^3 (chromate)	Ih, Ig, Con (chromate)	Respiratory, eyes, dermis, skin irritation, discoloration, mucous membrane ulcerating, perforated septum (chromate)	Skin (chromate)	Yes – 1-IARC Ca-OSHA(chromate)
Potassium nitrate (7757-79-1)	None established	Ih, Ig, Con	Respiratory irritation, (ingestion, gastrointestinal pain, nausea, and vomiting)	None identified, primarily a localized irritant	No
Potassium phosphate (7778-77-0)	None established	Ih, Ig, Con	Eyes, minor skin irritation	None identified, primarily a localized irritant	No
Potassium sulfate (7778-80-5)	None established.	Ih, Ig	None identified	None identified	No
Silver (7440-22-4)	TWA: 0.1 mg/m^3 TWA: 0.01 mg/m^3 (soluble compounds as silver)	Ih, Ig, Con	Blue-gray eyes, nasal septum, throat and skin irritation, ulceration skin, gastrointestinal disturbance	Nasal septum, skin, eyes	No
Sodium chloride (7647-14-5)	None established	Ih, Ig, Con	Eyes, irritation of mucous membranes	None identified, primarily a localized irritant	No

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Sodium cyanide (143-33-9)	TWA: 5 mg/m^3	Ih, Ig, Con	Irritation of eyes and skin, asphyxia, lassitude (weakness, exhaustion), headache, confusion, nausea, vomiting, increased respiratory rate, slow gasping respiration, thyroid, blood changes	Eyes, skin, cardiovascular system, central nervous system, thyroid, blood	No
Sodium dichromate (10588-01-9)	TWA: —0.05 mg/m^3 (chromate)	Ih, Ig, Con (chromate)	Respiratory, eyes or skin irritation, ulcerating (chromate)	Kidneys, liver (chromate)	Yes – IARC Ca-OSHA (chromate)
Sodium hydroxide (1310-73-2)	Ceiling: 2 mg/m^3	Ih, Ig, Con	Irritation of eyes, skin, and mucous membranes; pneuitis; burns; hair loss	Eyes, skin, respiratory system	No
Sodium nitrate (7631-99-4)	None established	Ih, Ig, Con	Respiratory, eyes, dermis, (inhalation or ingestion may cause cyanosis)	None identified, primarily a localized irritant	No
Sodium phosphate (7558-79-4)	None established	Ih, Ig, Con	Respiratory, eyes, dermis	None identified, primarily a localized irritant	No
Sodium sulfate (7757-82-6)	None established	Ih, Ig, Con	Respiratory, eyes, dermis	None identified, primarily a localized irritant	No
Sulfuric acid (7664-93-9)	TWA: 1 mg/m^3	Ih, Ig, Con	Irritation of eyes, skin, nose, and throat; pulmonary edema; bronchitis; emphysema; stomatis; dental erosion; tracheal bronchitis; burns; dermatitis	Eyes, skin, respiratory system, teeth	Yes for sulfuric acid in strong inorganic acid mist – A2-ACGIH 1-IARC
Tetrachloroethene (127-18-4) IE = 9.3 eV	TWA: 25 ppm STEL: 100 ppm	Ih, Ig, Con	Eye, skin, nose, throat, and respiratory system irritation; nausea; flush face or neck; vertigo; dizziness; uncoordination; headache; somnolence; skin erythema; liver damage	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Yes – Ca- NIOSH 2A-IARC A3-ACGIH

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
1,1,1-trichloroethane (71-55-6) IE = 11.1 eV	TWA: 350 ppm STEL: 450 ppm	Ih, Ig, Con	Eye and skin irritation; headache; lassitude; central nervous system depressant or depression; poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, central nervous system, cardiovascular system, liver	Yes – A4 – ACGIH 3-IARC
Trichloroethylene (79-01-6) IE = 9.5 eV	TWA: 50 ppm STEL: 100 ppm	Ih, Ig, Con	Eye and skin irritation; headache; vertigo; visual disturbance; fatigue; giddiness; tremor; somnolence; nausea; vomiting; dermatitis; cardiac arrhythmias; paresthesia; liver injury	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Yes – Ca-NIOSH A5-ACGIH 2A-IARC
Toluene (108-88-3) IE = 8.8 eV	TWA: 50 ppm	Ih, Ig, Abs, Con	Irritation of eyes and nose; fatigue; weakness; dizziness; headache; dilated pupils; muscle fatigue; insomnia; paresthesia; liver or kidney damage	Eyes, skin, respiratory system, central nervous system, kidneys, liver	Yes – A4 – ACGIH 3-IARC
Tributyl phosphate (126-73-8)	TWA: 0.2 ppm	Ih, Ig, Con	Irritation of eyes, skin, and respiratory system; headache; nausea	Eyes, skin, respiratory system	No
Uranium (insoluble U) (7440-61-1)	TWA: 0.2 mg/m^3 STEL: 0.6 mg/m^3	Ih, Ig, Con	Dermatitis, kidney damage, blood changes	Skin, eyes, bone marrow, lymphatic system	Yes – A1 – ACGIH Ca-NIOSH
Xylene (total) (1330-20-7) IE = 8.6 eV	TWA: 100 ppm STEL: 150 ppm	Ih, Ig, Con	Headache, loss of appetite, nervousness and pale skin, skin rash, eye damage, damage to bone marrow, causing low blood cell count, liver and kidney damage	Skin, eyes, blood, liver, kidneys	Yes – 3-IARC A4-ACGIH
Zirconium (7440-67-7)	TWA: 5 mg/m^3 STEL: 10 mg/m^3	Ih, Con	Skin, lung granulomas, irritation skin, mucous membrane; x-ray evidence of retention in lungs	Skin, respiratory system	Yes- A4-ACGIH

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)
Radionuclides (radiation fields)	ALARA dose limit in accordance with RWP. Posting of radiation areas in accordance with "Radiological Control Manual" (PRD-183). Thermoluminescent dosimeters will be used to measure whole-body total effective dose equivalent	Whole body	Alarming electronic dosimetry or stationary radiation monitors or alarms, and elevated readings on direct-reading instruments. (Note: Due to the extreme exposure levels required for noticeable biological symptoms to manifest, the project will utilize instrumentation as the indicator of radiological exposure levels.)	Blood-forming cells, gastrointestinal tract, and rapidly dividing cells	Yes – IARC
Radionuclides (fixed and removable surface contamination)	ALARA dose limit in accordance with RWP. Posting of contamination areas in accordance with "Radiological Control Manual" (PRD-183).	Ih, Ig, broken skin	Alarming constant air monitors, high counts on portable air samplers, direct-reading instruments, swipe counter (scaler), and alarm indication on personal contamination monitors. (Note: Due to the extreme exposure levels required for noticeable biological symptoms to manifest, the project will utilize instrumentation as the indicator of radiological exposure levels.)	Gastrointestinal tract, ionization of internal tissue through uptake of radionuclides	Yes – IARC
Radionuclides (airborne radioactivity)	ALARA dose limit in accordance with RWP 10% of derived air concentration for specific radionuclide selected (10 CFR 835). Posting of airborne radioactivity areas in accordance with "Radiological Control Manual" (PRD-183).	Ih, Ig, broken skin	Alarming constant air monitors, high counts on portable air samplers, and personal air samplers. (Note: Due to the extreme exposure levels required for noticeable biological symptoms to manifest, the project will utilize instrumentation as the indicator of radiological exposure levels.)	Gastrointestinal tract, ionization of internal tissue through uptake of radionuclides	Yes – IARC

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, and Ionization Energy)	Exposure Limit (PEL/TLV)	Routes of Exposure	Indicators or Symptoms of Overexposure (Acute and Chronic)	Target Organs and System	Carcinogen? (source)

Abs = absorption
ACGIH = American Conference of Government Industrial Hygienists
ALARA = as low as reasonably achievable
Con = contact
IARC = International Agency for Research on Cancer
Ig = ingestion
Ih = inhalation
NIOSH = National Institute of Occupational Safety and Health
NTP = National Toxicology Program
OSHA = Occupational Safety and Health Administration
PEL = permissible exposure limit
RWP = radiological work permit
STEL = short-term exposure limit
TLV = threshold limit value
TWA = time-weighted average

Table 2-5. Summary of project operational activities, associated hazards, and mitigation.[a]

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Construction – Site Development and Utilities		
• Overburden removal • Site excavation • Site grading and pad construction	Radiological: Contamination—waste material Radiation exposure—waste material Airborne radioactivity—dust from waste material	Controlled access, qualified equipment operator, use of dust suppression measures, RWP, RCT coverage, direct-reading instruments, air monitoring equipment, compliance with "Radiological Control Manual" (PRD-183) radiological posting requirements, PPE, use of TLDs and supplemental dosimetry, and contamination surveys.
• Utilities connection and installation • Equipment/facility placement	Chemical and nonradiological contaminants—waste material, airborne contaminants, chemical use for project construction, equipment operation (CO), excavator fuel, and preventive maintenance	Controlled access, IH monitoring as appropriate using direct reading instruments or personnel monitoring based in IH judgment, follow JSAs, MSDS for all chemicals brought onsite, natural ventilation of areas, all personnel shall leave the area and notify IH if unusual odors are detected by personnel.
	Pinch points and struck-by or caught-between hazards—equipment movement and vehicle traffic, forklift movement, and hoisting and rigging	"Hoisting and Rigging" (PRD-2007) requirements, equipment inspections, qualified equipment operators (hoisting and rigging) and forklift operators, backup alarms, controlled access, JSAs, designated traffic lanes and areas, watch body position, and PPE.
	Elevated work—falls from heights on elevated surfaces, aerial lifts, and ladders	Fall protection in accordance with "Fall Protection" (PRD-2002), aerial lifts in accordance with "Aerial Lifts and Elevating Work Platforms" (PRD-2006), and ladder work in accordance with "Ladders" (PRD-2003).
	Excavation hazards—overburden removal, facility foundation excavation, utilities excavation, and other earth work and excavations	Control access, and maintain safe perimeter around holes, pits, or excavations with proper slopes for stability in accordance with "Excavations and Surface Penetrations" (PRD-2014) competent person inspections.
	Hoisting and rigging—equipment and component movement and placement, and project overhead hoists	Qualified operators, equipment and rigging inspections, and hoisting and rigging operations in accordance with "Hoisting and Rigging" (PRD-2007).
	Lifting and back strain—staging equipment and support materials, and manual excavation of overburden	Mechanical equipment to lift and position heavy items, proper lifting techniques, two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward or unbalanced, and body position awareness.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection	Work-area temperature monitoring, PPE, training, work and rest cycles as required (MCP-2704), and stay times if required are documented on SWP.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain; ice-, snow-, and mud-covered or wet surfaces; probes in pit; lines and cords; ladders; and SDA subsidence	Good housekeeping, awareness of walking surfaces, salt and sand icy areas (where beneficial), and use of nonskid or high-friction materials on walking surfaces, lines, and cords maintained out of established aisles and walkways, proper footwear, and three-point contact when ascending and descending ladder. Follow SDA subsidence rules when in effect and personnel awareness of subsidence signs (i.e., cracks and depressions, holes in overburden, and voids).
	Stored energy sources—elevated materials, electrical, battery-powered tools and equipment, compressed gases, hoisting and rigging, fire (refueling), and running vehicles	Secure all materials stored at elevated locations; identify and mark all utilities; ensure all lines and cords are checked for damage and continuity; use GFCI (circuit or receptacle) for all outdoor equipment and for all temporary installation; comply with minimum clearances for overhead line; process outage for buried lines and secure compressed cylinders, caps, and bottles before movement; conduct inspections of equipment, grounding and bonding during all refueling operations; set brake and use tire chocks where appropriate; and do not leave any running vehicles or equipment unattended.
	Hazardous noise—areas around equipment and when operating equipment	Source identification and labeling, IH sound-level monitoring and dosimetry, isolation, and PPE (as required).
	Lasers	Follow requirements in PRD-2112, “Lasers,” for the laser handling, training, and exposure requirements.
	Confined spaces	Follow PRD-2110, “Confined Spaces,” requirements for evaluating and working in confined spaces.
Construction – Retrieval Enclosure, Airlock, and Storage Enclosure Installation		

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
• Assembly of the Retrieval Enclosure • Assembly of the airlock • Installation of equipment and support facilities • Assembly of waste storage enclosure	Radiological: Contamination—waste material Radiation exposure—waste material Airborne radioactivity—dust from waste material	Controlled access, qualified equipment operator, use of dust suppression measures, RWP, RCT coverage, direct-reading instruments, air monitoring equipment, compliance with "Radiological Control Manual" (PRD-183) radiological posting requirements, PPE, use of TLDs and supplemental dosimetry, and contamination surveys.
	Chemical and nonradiological contaminants—waste material, airborne contaminants, chemical use for project construction, equipment operation (CO), excavator fuel, and preventive maintenance	Controlled access, IH monitoring as appropriate using direct reading instruments or personnel monitoring based in IH judgment, follow JSAs, MSDS for all chemicals brought onsite, natural ventilation of areas, all personnel shall leave the area and notify IH if unusual odors are detected by personnel.
	Pinch points, and struck-by or caught-between hazards—equipment movement and vehicle traffic, and forklift movement	"Hoisting and Rigging" (PRD-2007) requirements, equipment inspections, qualified equipment operators and forklift operators, backup alarms, controlled access, JSAs, designated traffic lanes and areas, watch body position, and PPE.
	Hoisting and rigging—equipment and component movement and placement, and project overhead hoists	Qualified operators, equipment and rigging inspections, and hoisting and rigging operations in accordance with "Hoisting and Rigging" (PRD-2007).
	Elevated work—falls from heights on elevated surfaces, aerial lifts, and ladders	Fall protection in accordance with "Fall Protection" (PRD-2002), aerial lifts in accordance with "Aerial Lifts and Elevating Work Platforms" (PRD-2006), and ladder work in accordance with "Ladders" (PRD-2003).
	Excavation hazards—overburden removal, facility foundation excavation, utilities excavation, and other earth work and excavations	Control access, and maintain safe perimeter around holes, pits, or excavations with proper slopes for stability in accordance with "Excavations and Surface Penetrations" (PRD-2014) competent person inspections. Follow "Heavy Industrial Vehicles" (PRD-2020).
	Lifting and back strain—staging equipment and support materials, and manual excavation of overburden	Mechanical equipment to lift and position heavy items, proper lifting techniques, two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward or unbalanced, and body position awareness.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Stored energy sources—elevated materials (drums and hoisted materials and waste), electrical, battery-powered tools and equipment, and running industrial vehicles (e.g., forklift)	Secure all materials stored at elevated locations, inspect all lines and cords before use, use GFCI (circuit or receptacle) for all outdoor equipment and where liquids may be present, conduct inspections of tools, set brake and use tire chocks where appropriate, and do not leave any running vehicles or equipment unattended.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection	Work-area temperature monitoring, PPE, training, work and rest cycles as required (MCP-2704), and stay times if required are documented on SWP.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, mud-covered or wet surfaces, lines and cords, ladders, and SDA subsidence	Good housekeeping, awareness of walking surfaces, lines and cords maintained out of established aisles and walkways, proper footwear, and three-point contact when ascending and descending ladder. Follow SDA subsidence rules when in effect and personnel awareness of subsidence signs (i.e., cracks and depressions, holes in overburden, and voids).
	Elevated work—falls from heights on elevated surfaces, aerial lifts, and ladders	Fall protection in accordance with "Fall Protection" (PRD-5096), aerial lifts in accordance with "Aerial Lifts and Elevating Work Platforms" (PRD-5107), and ladder work in accordance with "Ladders" (PRD-5067).
	Hazardous noise—equipment operations	Source identification and labeling, IH sound-level monitoring or dosimetry, isolation, and PPE (as required).
	Lasers	Follow requirements in PRD-2112, "Lasers," for the laser handling, training, and exposure requirements.
	Confined spaces	Follow PRD-2110, "Confined Spaces," requirements for evaluating and working in confined spaces.
Operations – Waste Retrieval and Handling in Retrieval Enclosure		

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
• Waste excavation • Waste-container handling • RCT surveys and monitoring	Radiological: Contamination—waste material Radiation exposure—waste material	Excavator and telehandler HEPA filtration, facility ventilation, dust suppression system, routine decontamination of equipment, controlled access, TPRs, qualified positions (where required), RWP, direct-reading instruments, collection and counting of swipes, compliance with "Radiological Control Manual" (PRD-183) radiological posting requirements, PPE, use of TLDs and supplemental dosimetry, and contamination surveys.
• General tasks inside Retrieval Enclosure	Chemical and nonradiological contaminants—waste excavation and container handling, chemical use for project operations, equipment operation, refueling, and preventive maintenance	Excavator and telehandler HEPA filtration, facility ventilation, dust suppression system, equipment exhaust srubbing systems, routine decontamination of equipment, controlled access; area monitors and direct-reading instruments; TPRs; JSAs; MSDS for all chemicals used; and PPE.
	Pinch points, struck-by or caught-between hazards—equipment, drum movement, forklift operations, and material-handling tasks	Control access, Technical procedures, equipment inspections, qualified equipment operators, JSAs, backup alarms, personnel awareness and proper body position, and PPE.
	Excavation hazards—waste excavation and removal and other earth work and excavation	Control access; maintain safe perimeter around holes, pits, or excavations with proper slopes for stability ; and periodic inspections. Implement "Heavy Industrial Vehicles" (MCP-2745).
	Lifting and back strain—material handling, handling and positioning waste containers, and sample movement	Mechanical lifting devices (e.g., forklift) to lift and move heavy waste items, proper lifting techniques, two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward or unbalanced, and awareness of body position. An IH may perform ergonomic assessments as deemed appropriate.
	Heat and cold stress—support work outdoors	Implement "Heat and Cold Stress" (MCP-2704) monitoring by IH, PPE, training, and work-rest cycles (as required).
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, ice-, snow-, mud-covered or wet surfaces, lines and cords, entry into waste storage area, and ladders	Good housekeeping, awareness of walking surfaces, lines and cords maintained out of established aisles and walkways, proper footwear, and three-point contact when ascending and descending ladder. Follow SDA subsidence rules when in effect, personnel awareness of subsidence signs (i.e., cracks and depressions, holes in overburden, and voids).

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Stored energy sources—elevated materials (stored drums and waste), compressed gas, battery-powered tools and equipment, and running industrial vehicles (e.g., forklift)	Secure all materials stored at elevated locations; inspect all lines and cords before use; use GFCI (circuit or receptacle) for all outdoor equipment and where liquids may be present; secure compressed cylinders, caps, and bottles before movement; conduct inspections of tools; set brake and use tire chalks where appropriate; and do not leave any running vehicles or equipment unattended.
	Electrical—use of electrical equipment or equipment in area where water or wet surfaces are present	Use of GFCI outlets or extension cords outdoors and where water or wet surfaces are present. Use of barrier material to isolate electrical cords from water.
	Hazardous noise—areas around operating equipment	Enclosed equipment cabs, Source identification and labeling, IH sound-level monitoring or dosimetry, isolation, and PPE (as required).
Waste Processing and Handling in Airlock Two utilizing the Drum Packaging Stations		
• Waste sorting, inspection, and sampling • Waste handling and packaging	Radiological: Contamination—waste material Radiation exposure—waste material	Drum Packaging Stations, ventilation system, decontamination activities, controlled access, TPRs, qualified positions (where required), RWP, direct-reading instruments, collection and counting of swipes, compliance with "Radiological Control Manual" (PRD-183) radiological posting requirements, PPE, use of TLDs and supplemental dosimetry, and contamination surveys.
• Waste handling and drum staging • Maintenance of systems	Chemical and nonradiological contaminants—contaminants associated with decontamination process and secondary waste streams generated	Drum Packaging Stations, ventilation system, decontamination activities, HEPA vacuum system, controlled areas, JSAs, SWPs (as required), air monitoring and sampling, direct-reading instruments, TPRs, and PPE.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
systems	Pinch points, struck-by, and caught-between hazards—positioning items, material handling, waste packaging, and hoisting and rigging	Technical procedures, control access, equipment inspections, qualified operators, JSAs, backup alarms on forklifts, maintain proper body position, implement equipment and rigging inspections; hoisting and rigging operations in accordance with "Hoisting and Rigging Operations" (MCP-6501), "Hoisting and Rigging Maintenance" (MCP-6502), "Inspection and Testing of Hoisting and Rigging Equipment" (MCP-6503), "Hoisting and Rigging Lift Determination and Lift Plan Preparation" (MCP-6504), and "Hoisting and Rigging Training" (MCP-6505), and utilize PPE.
	Ergonomics, lifting and back strain—moving and positioning equipment and containers, performing work through gloveports	Qualified operators, use mechanical lifting devices where possible, proper lifting techniques and two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or in awkward or unbalanced situations, and an IH will conduct ergonomic evaluation of tasks (as required). Utilize the nearest gloveports to access work area, Use teamwork and reach tools to avoid over-extending.
	Heat and cold stress—working in PPE	Engineering controls—maintain room temperatures cool or warm as appropriate. Monitoring by IH, PPE, training, and work-rest cycles as required (MCP-2704).
	Electrical—use of electrical equipment in area where water or wet surfaces are present	Use of GFCI outlets, inspect cords prior to use. Use of barrier material to isolate electrical cords from water.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain,	Awareness of walking surfaces, use nonskid or high-friction materials on walking surfaces as necessary to minimize slick surfaces, and wear adequate footwear with traction sole.
	Fall hazards—ladders and elevated work surfaces	Qualified personnel, inspect equipment prior to use, guardrailing and toeboards on elevated platforms, Fall protection in accordance with "Fall Protection" (PRD-5096), aerial lifts in accordance with "Aerial Lifts and Elevating Work Platforms" (PRD-5107), and ladder work in accordance with "Ladders" (PRD-5067).
Airlock One Operational Activities		

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
• Access Excavator and telehandler equipment. • Recharge breathing air on equipment • Fuel equipment	Radiological contamination—contact with waste material, contaminated equipment, and components Radiation exposure—in close proximity to waste containers and contamination with associated dose rate	Excavator and telehandler HEPA filtration, breathing air systems, dust suppression system, decontamination of equipment and airlock, controlled access, RWP, RCT surveys, work package hold points, direct-reading instruments, collection and counting of swipes, compliance with "Radiological Control Manual" (PRD-183) radiological posting requirements, PPE, use of dosimetry and survey requirements, and as low as reasonably achievable principles.
• Refill the excavator surfactant reservoir • Decontaminate equipment and airlock as necessary	Chemical and inorganic contaminants—contact with waste material, contaminated equipment, and components; hydraulic fluids; fuel; and use of chemicals associated with maintenance tasks	Controlled areas, Excavator and telehandler HEPA filtration, breathing air systems, dust suppression system, decontamination of equipment and airlock, controlled access, equipment exhaust scrubbing systems, JSAs, SWPs (as required), work package hold points, air monitoring and sampling, direct-reading instruments, MSDS for all chemicals, and PPE.
• Inspect and maintain equipment. • Access the Retrieval Enclosure	Pinch points, struck-by or caught-between hazards—equipment movement, material-handling tasks, equipment repair activities.	Work orders or procedures, equipment inspections, qualified operators, JSAs, designated equipment parking areas, backup alarms on excavator and forklift, maintain safe body position , keep personnel out of airlock area when equipment is entering and leaving (moving) around in the airlock bays, and utilize PPE.
	Ergonomics, lifting and back strain—moving and positioning components	Use mechanical lifting and positioning devices, proper lifting techniques, and two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward and unbalanced, and IH conduct ergonomic evaluation of tasks (as required).
	Heat and cold stress— in PPE	Industrial hygienist monitoring, PPE, training, work-rest cycles as required (MCP-2704), and stay times documented on SWP or pre-job briefing (or equivalent).
	Tripping hazards and working-walking surfaces—uneven surfaces and terrain, and ladders	Awareness of walking surfaces, use nonskid or high-friction materials on walking surfaces, maintain good housekeeping, wear adequate footwear with traction sole, and three-point contact when ascending and descending ladder.
	Electrical – use of electrical equipment	Use GFCI protection, inspect cords prior to use, Protect cords from damage.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Stored energy—electrical, mechanical, thermal, battery-powered equipment and tools, elevated materials, pressurized systems, cylinders, flammable/combustible liquid systems, and fire systems	Piping and conduit labeling; lockout and tagout training; "Integrated Work Control Process" (STD-101) work packages; and lockout and tagout in accordance with "Chapter IX Level I Lockouts and Tagouts" (MCP-3650), "Chapter IX Level II Lockouts and Tagouts" (MCP-3651), and "Chapter IX-Lockout and Tagout" (PRD-5051).
	Elevated work	Fall protection training, use of fall protection system and devices, fall protection competent person, and follow all requirements of "Fall Protection" (PRD-5096).
Operations – Waste-Container assay, handling, and storage		
• Waste-container handling • Source handling and calibration • Liquid nitrogen handling	Radiological: Contamination—waste material Radiation exposure—hot particles or dose rate associated with waste-container and source handling	Engineering controls (ventilation and shielding), controlled areas, TPRs, RWP, RCT surveys, fixed and portable air-sampling instruments, hold points, direct-reading instruments, collection and counting of swipes, compliance with "Radiological Control Manual" (PRD-183) radiological posting requirements, PPE, use of dosimetry and survey requirements, and as low as reasonably achievable principles.
	Chemical and nonradiological contaminants—contaminants associated with waste, compressed gas cylinders, and liquid nitrogen	Controlled areas, engineering controls (ventilation), TPRs, JSAs, SWPs (as required), MSDS for chemicals used (LN_2), implement "Cryogenic Liquids" (PRD-5038), sampling, direct-reading instruments, and PPE.
	Pinch points, struck-by, or caught-between hazards—vehicle and equipment movement, and material and equipment handling	Vehicles use traffic lanes and ramps, backup alarms on heavy equipment and industrial vehicles, JSAs, TPRs, watch body position, and wear PPE.
	Lifting and back strain—moving and positioning waste containers, positioning equipment, equipment and supplies or components	Use mechanical lifting devices where possible, proper lifting techniques and two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward and unbalanced, and IH conduct ergonomic evaluation of tasks (as required).
	Heat and cold stress—working outdoors and in PPE	Industrial hygienist monitoring, PPE, training, work-rest cycles as required (MCP-2704), and stay times documented on SWP or pre-job briefing (or equivalent).

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Tripping hazards and working-walking surfaces—uneven surfaces and terrain; ice- and snow-covered and wet surfaces; plastic sheeting; cords, hoses, and lines; and ladders	Awareness of walking surfaces, salt and sand icy areas, and use nonskid or high-friction materials on walking surfaces, keep lines and cords out of established aisles and walkways, and wear adequate footwear with traction sole.
	Electrical—use of electrical equipment or equipment in area where water or wet surfaces are present	Use of GFCI protection, inspect cords prior to use, Use of barrier material to keep electrical cords out of water.

a. All hazards will be identified and evaluated, and controls will be established in accordance with "Activity Level Hazard Identification, Analysis, and Control" (PRD-25) requirements. Additionally, project-assigned IH, safety professional, and Radiological Control personnel will be available to assist with the "Activity Level Hazard Identification, Analysis, and Control" process and to assist in the develop of TPRs, work orders or packages, and permits associated with project operational activities.

GFCI = ground-fault circuit interrupter
IH = industrial hygienist
JSA = job safety analysis
MSDS = material safety data sheet
PPE = personal protective equipment
RCT = radiological control technician
RWP = radiological work permit
SDA = Subsurface Disposal Area
SWP = safe work permit
TLD = thermoluminescent dosimeter
TPR = technical procedure

2.2 Safety and Physical Hazards and Mitigation

Industrial safety and physical hazards will be encountered while performing project operations. Section 4.2 provides general safe work practices that must be followed at all times. This section describes specific industrial safety hazards and procedures to be followed to eliminate or minimize safety and physical hazards that will be encountered by project personnel.

2.2.1 Material Handling and Back Strain

Material handling and maneuvering of various pieces of equipment, drums, and waste during project operations may result in employee injury. Mechanical lifting devices such as hoists, drum handlers, and forklifts will be used wherever possible to eliminate the need for manual materials handling and lifting. Where these devices are not feasible, lifting and material-handling tasks will be performed in accordance with "Ergonomics Program" (MCP-2692). Construction personnel shall follow "Material Handling, Storage, and Disposal" (PRD-2016). Personnel will not physically lift objects weighing more than 50 lb or 33% of their body weight alone (whichever is less).

2.2.2 Working and Walking Surfaces

Slippery and uneven work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. Project operations inside the Retrieval Enclosure and airlocks will present potential tripping or slip hazards from uneven flooring surfaces, equipment cords or hoses, pit surface subsidence after overburden excavation, and wet surfaces or floor obstructions. Outside the Retrieval Enclosure and airlocks, the potential for slip, trip, and fall hazards will increase during winter months because of ice- and snow-covered surfaces. All personnel will be made aware of tripping hazards that cannot be eliminated by marking them (e.g., probes). All construction and operations personnel will wear required protective footwear with adequate sole traction to further mitigate slip and fall potential. Tripping and slip hazards will be evaluated during the course of project operations in accordance with "Walking and Working Surfaces" (PRD-5103) and during construction in accordance with "Walking and Working Surfaces" (PRD-2005).

The floor of the airlocks shall be maintained, so far as possible, in a clean and dry condition. All walking and working surfaces will be kept clean, orderly, and free of foreign objects to prevent possible slip, trip, and fall hazards. Proper drainage and use of mats will be considered for use and implemented as determined necessary where wet conditions are present that could cause a potential slip and fall hazard. All tools and equipment used during each shift will be placed back in the designated storage location, unless required to be left in place. Cords and lines will be routed around walkways, traffic lanes, stairs, and entrances and exits to eliminate tripping hazards. Elevated walkways and platforms will be provided with guardrailing and toeboards, and kept clear of potential tripping hazards.

2.2.3 Elevated Work Areas

Personnel performing construction, maintenance tasks, or other operations may be required to work on elevated equipment or at heights above 1.2 m (4 ft) . Personnel required to access the area around the excavation shall be protected from falling by the use of barricades positioned 1.8 m (6 ft) back from the edge or maintain safe body position as directed by excavation-competent person in accordance with "Excavation and Surface Penetration" (PRD-22) or "Excavations and Surface Penetrations" (PRD-2014) for construction personnel. Personnel shall use guardrail systems, personal fall-arrest systems, or fall-restraint system (travel restriction system) that protects personnel from a fall hazards based on fall-hazard-competent person evaluation in accordance with "Fall Protection" (PRD-5096) or "Fall Protection" (PRD-2002) for construction personnel.

Additionally, the following MCP requirements will be followed as they relate to project operations associated with elevated work:

- "Aerial Lifts and Elevating Work Platforms" (PRD-5107) (operations)
- "Aerial Lifts and Elevating Work Platforms" (PRD-2006) (construction)
- "Ladders" (PRD-5067) (operations)
- "Ladders" (PRD-2003) (construction)
- "Scaffolding" (PRD-5098) (operations)
- "Scaffolding" (PRD-2004) (construction).

2.2.4 Means of Egress

Established means of egress (continuous and unobstructed way of travel to an exit, exit access, and exit discharge) shall be maintained within all Retrieval Enclosure and airlock areas in accordance with "Life Safety Code" (NFPA 101) requirements or the Project Fire Hazards Analysis (HAD-266). This includes emergency lighting, illumination of signs, and marking of means of egress in accordance with the fire hazards analysis for the Accelerated Retrieval Project.

2.2.5 Powered Equipment and Tools

Powered equipment and tools will be used during project construction and operations. Use of this equipment presents potential physical hazards (e.g., pinch points, electrical hazards, flying debris, and struck-by and caught-between hazards) to personnel operating them. All portable equipment and tools will be properly maintained and used by qualified individuals and in accordance with the manufacturer's specifications. At no time will safety guards be removed. Requirements from "Portable Equipment and Handheld Power Tools" (PRD-5101) will be followed for all work performed with powered equipment including hand tools by operations and maintenance personnel. Construction personnel shall implement the requirements in "Hand and Portable Power Tools" (PRD-2015). All tools will be inspected by the user before use.

2.2.6 Electrical Hazards and Energized Systems

Electrical equipment and tools, as well as construction and maintenance of project facility electrical systems, may pose shock or electrocution hazards to personnel. Ground-fault-protected electrical circuits and receptacles in combination with safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. All electrical work will be reviewed and completed under the appropriate work controls (e.g., TPRs or work orders). Before conducting electrical work, hazardous energy of the affected system will be brought to a zero energy state through the use of isolation methods in accordance with the following:

- "Chapter IX Level I Lockouts and Tagouts" (MCP-3650) (operations and maintenance)
- "Chapter IX Level II Lockouts and Tagouts" (MCP-3651) (operations and maintenance)
- "Lockouts and Tagouts" (PRD-2012) (construction only).

If work on energized systems during operations or maintenance is necessary, these practices will conform to the requirements in "Electrical Safety" (PRD-5099) or "Electrical Safety" (PRD-2011) for construction personnel. Additionally, all electrical and other utilities will be identified before conducting surface penetration maintenance activities in accordance with "Excavation and Surface Penetration" (PRD-22) for maintenance and operations tasks and "Excavations and Surface Penetrations" (PRD-2014) for construction personnel.

2.2.7 Operational Fire Hazards and Prevention

The "Fire Hazards Analysis for the Accelerated Retrieval Project for a Described Area within Pit 4" (HAD-266) identifies the fire hazards and mitigations to protect the project facilities and operations. The protective actions and requirements in the fire hazards analysis will be implemented to minimize fire hazards and to protect personnel and property during project tasks.

2.2.8 Flammable and Combustible Material Hazards

Fuel will be required for the heavy equipment, excavator, forklifts, and other equipment during project operations. Flammable hazards include transfer and storage of flammable or combustible liquids in the project construction and operations area. Portable fire extinguishers with a minimum rating of 10A/ 60 BC shall be strategically located at the facility to combat Class ABC fires. Portable fire extinguishers will be located in all active project operations areas, on or near all facility equipment that has exhaust heat sources, and on or near all equipment capable of generating ignition or having the potential to spark. The requirements of "Handling and Use of Flammable and Combustible Liquids" (PRD-308) for maintenance and operations and "Flammable and Combustible Liquid Storage" (PRD-2201) for construction activities will be followed at all times. The use of liquefied petroleum at the project site will comply with "National Fuel Gas Code" (NFPA 54) for installation and use. Liquefied petroleum installations will be safely positioned and protected from equipment damage, as appropriate.

2.2.9 Welding, Cutting, or Grinding

Personnel conducting welding, cutting, or grinding tasks may be exposed to molten metal, slag, and flying debris. Additionally, a fire potential exists if combustible materials are not cleared from the work area. Requirements from "Welding, Cutting, and Other Hot Work" (PRD-5110) will be followed whenever these types of activities are conducted by maintenance or operations personnel. The requirements of "Welding, Cutting, and other Hot Work" (PRD-2010) will be implemented during construction activities. This includes the requirement for a hot work permit and designation of a fire watch.

2.2.10 Pressurized Systems

Pressurized plant and breathing air systems will be operated in support of project operations. The hazards presented to personnel, equipment, facilities or the environment because of inadequately designed or improperly operated pressure systems (vessels) include blast effects, shrapnel, fluid jets, equipment damage, personnel injury, and death. These systems can include pneumatic, hydraulic, or compressed-gas systems. The applicable requirements in "Handling and Use of Compressed Gases" (PRD-5040), "Pressure System Safety" (PRD-320), and "Boilers and Unfired Pressure Vessels" (PRD-5) must be followed as well as the manufacturer's operating and maintenance instructions. This includes inspection, maintenance, and testing of systems and components in accordance with applicable American National Standards Institute requirements.

Additionally, all hoses, fittings, lines, gauges, and system components will be rated for the system for at least the maximum allowable working pressure (generally the relief set point). The project safety professional should be consulted about any questions of pressure systems in use at the project site.

2.2.11 Cryogenics

Cryogenics may be used in support of project operations for cooling of detectors or other applications. If required, all cryogenic tasks will be conducted and protective equipment worn in accordance with "Cryogenic Liquids" (PRD-5038). Personal protective equipment will be worn at all times when handling, transferring, or dispensing cryogenic liquids in accordance with "Cryogenic Liquids" (PRD-5038) to minimize the potential for cryogenic burns or frost bite due to contact with the cryogenic liquid or super-cooled surfaces. Additional hazards associated with cryogenic liquids include the following:

- **Pressure buildup:** Boiling of liquefied gases within a closed system increases pressure. Cryogenic liquids will not be contained in a closed system other than an approved dewar. Cold fingers and similar devices have exploded when either an ice dam has formed within the apparatus or when users created a closed system by shutting off all of the valves.

- **Oxygen enrichment:** Liquid nitrogen may fractionally distill air, causing liquid oxygen to collect in the cryogenic container. Liquid oxygen increases the combustibility of many materials, creating potentially explosive conditions. Adequate venting will be provided when working with cryogenic liquids in a closed system or enclosed space.

- **Asphyxiation:** If vented into a closed space, a cryogenic liquid will vaporize, displacing oxygen and possibly causing asphyxia. Cryogenic liquid will not be stored in a closed space.

- **Embrittlement:** Cryogenic liquids will not be disposed of down any drains. Ordinary materials such as metal or PVC piping may not be able to withstand cryogenic temperatures. Cryogenic liquids will be allowed to evaporate in a well-ventilated area. Materials exposed to cryogenic temperatures for long periods or materials that have undergone periodic warming and freezing will be examined regularly for cracks and warping.

2.2.12 Compressed Gases

Compressed gases will be used in support of project construction, maintenance, and operations. All cylinders will be used, stored, handled, and labeled in accordance with "Handling and Use of Compressed Gases" (PRD-5040) for maintenance and operations activities and "Compressed Gases" (PRD-2009) for construction activities. Additionally, the assigned project safety professional should be consulted about any compressed gas cylinder storage, transport, and use issues.

2.2.13 Heavy Equipment and Vehicle Hazards

Heavy equipment, forklifts, and vehicles will be used as part of the project construction, maintenance, and operations. Hazards associated with the operation of the heavy equipment, forklifts, and vehicles include injury to personnel (e.g., struck-by and caught-between hazards), equipment contact with the structures, and property damage. All equipment will be operated in the manner in which it was intended and in accordance with the manufacturer's instructions or equipment design. Only authorized and qualified personnel will be allowed to operate equipment. Personnel in proximity to operating equipment must maintain visual communication with the operator and stay out of the excavator or crane swing radius, which will be barricaded to protect personnel in the area from being struck, as appropriate

based on the configuration. Personnel also must comply with the applicable requirements of the following:

- "Heavy Industrial Vehicles" (MCP-2745) (operations and maintenance)
- "Heavy Industrial Vehicles" (PRD-2020) (construction)
- "Motor Vehicle Safety" (PRD-5123) (operations and maintenance)
- "Motor Vehicle Safety" (PRD-2019) (construction).

2.2.14 Illumination

Construction and operational activities will be conducted with adequate lighting to support safe operations. The minimum illumination in the Retrieval Enclosure and at the construction area will comply with the requirements of "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120[m]) and "Powered Industrial Trucks" (29 CFR 1910.178[h]).

2.2.15 Excavation, Surface Penetrations, and Outages

The Accelerated Retrieval Project excavation will be maintained with an approximate slope of 1 to 1 to maintain surface stability. The equipment will not be operated inside the pit during normal operations. Personnel will not enter the pit without proper sloping and evaluations required in PRD-22, "Excavations and Surface Penetrations".

Buried utilities or lines are buried in the project area to be excavated. The requirements of "Excavations and Surface Penetrations" (PRD-2014) for construction and "Excavation and Surface Penetration" (PRD-22) for maintenance and operations will be applied to identify and protect from buried utilities and lines. An outage request will be submitted for required outages (e.g. buried utilities, roads, overhead power lines) and coordinated with the RWMC outage coordinator.

The applicable requirements of "Excavations and Surface Penetrations" (PRD-2014) for construction and "Excavation and Surface Penetration" (PRD-22) for maintenance and operations will be applied to all excavation activities including overburden removal, building site excavations, utility excavations, and waste excavations.

2.2.16 Hoisting and Rigging of Equipment

All hoisting and rigging during operations and maintenance will be performed in accordance with "Hoisting and Rigging Operations" (MCP-6501), "Hoisting and Rigging Maintenance" (MCP-6502), "Inspection and Testing of Hoisting and Rigging Equipment" (MCP-6503), "Hoisting and Rigging Lift Determination and Lift Plan Preparation" (MCP-6504), "Hoisting and Rigging Training" (MCP-6505), and "Hoisting and Rigging" (DOE-STD-1090-04) as applicable for these project operations. All construction hoisting and rigging activities will be conducted in accordance with the requirements of "Hoisting and Rigging" (PRD-2007).

Hoisting and rigging equipment will show evidence of a current inspection (e.g., tag) and be inspected before use by designated operators. Additionally, if mobile crane or boom trucks are used in support of project operations, the operator or designated person for mobile cranes or boom trucks will perform a visual inspection each day or before use (if the crane has not been in regular service) of items such as, but not limited to, the following:

- All control mechanisms for maladjustment that would interfere with proper operation
- Crane hooks and latches for deformation, cracks, and wear
- Hydraulic systems for proper oil level
- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage
- Hoist ropes for kinking, crushing, birdcaging, and corrosion
- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

Note: The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the safety professional.

2.2.17 Personal Protective Equipment

Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. In addition, PPE can increase the risk of heat stress. Work activities at the task site will be evaluated by Industrial Hygiene, Industrial Safety, and RadCon as necessary to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply with "Personal Protective Equipment" (PRD-5121) and "Radiological Personal Protective Equipment" (MCP-432). All personnel who wear PPE will be trained in its use and limitations in accordance with "Personal Protective Equipment" (PRD-5121) for maintenance and operations personnel and "Personal Protective Equipment" (PRD-2001) for construction personnel.

2.3 Environmental Hazards and Mitigation

Potential environmental hazards will present potential hazards to personnel during project operations. These hazards will be identified and mitigated to the extent possible. This section describes these environmental hazards and states what procedures and work practices will be followed to mitigate them.

2.3.1 Contaminants of Concern

The potential contaminants of concern (COCs) are discussed in detail in Section 2, and include radiological and nonradiological contaminants. The IH and radcon personnel will evaluate the potential COCs in Table 2-4, establish appropriate monitoring, and minimize personnel exposure to the COCs using engineering controls, administrative controls, and personal protective equipment including the following:

- HEPA filter ventilation in the Retrieval Enclosure that creates a slight negative pressure inside the retrieval enclosure, and moves the air from the airlocks into the retrieval enclosure, and out through the HEPA filtered exhaust stack equipped with a radiological emissions monitoring system.
- Positive pressurized HEPA filtered cabs on the excavator and the telehandler forklift used to retrieve waste inside the Retrieval Enclosure will reduce the levels of particulate contamination inside the equipment cabs where personnel are located during the operation of the equipment.

- The excavator and telehandler forklift used inside the facility are equipped with exhaust scrubber systems to reduce the diesel exhaust emissions (i.e. CO2, NOx, etc).

- Airlock One is designed to provide a cleaner area to perform the required tasks associated with the waste retrieval operations without entering the Retrieval Enclosure. Airlock Two provides an area where personnel sort, handle, and package the waste through gloveports and do not have to enter the Retrieval Enclosure.

- Video monitoring equipment installed on the retrieval equipment inside the Retrieval Enclosure and radio communications will be used by personnel positioned outside the Retrieval Enclosure to monitor the safe retrieval operations and assist in identifying target waste forms without requiring additional personnel to enter the Retrieval Enclosure.

- Dust suppression system on the excavator will be used to suppress the dust and spray surfactant on the soil and waste surfaces inside the Retrieval Enclosure to minimize dust creation.

- Monitoring and sampling for COCs will be performed to verify and monitor the contaminant levels and verify adequacy of the controls. The detected levels will be compared to applicable action levels or hold points and additional controls implemented per IH or RadCon direction to reduce personnel exposure as required.

- Access control into the Support Zone, Contamination Reduction Zones, Contamination Reduction Corridors, and the Exclusion Zone will be strictly enforced by operations. The zones will be clearly posted with access requirements. Unauthorized personnel will not be permitted in the work areas.

- The radiological postings and controls for the area will be posted and controlled in accordance with PRD-183.

- Decontamination of equipment and facilities will be performed to maintain the work environment acceptable for performing tasks inside the Retrieval Enclosure, airlocks, and other project areas.

- Personnel will be required to wear the appropriate PPE as described in section 5 for the tasks being performed and areas being accessed in accordance with the TPR, JSA, RWP, work order, or SWP.

2.3.2 Noise

Personnel performing project construction, operations, and maintenance activities may be exposed to noise levels from the heavy equipment, hand tools, and compressors that exceed 85 decibel A-weighted (dBA)for an 8-hour time-weighted average (TWA), 84 dBA for 10-hour TWA. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued

- Physical damage to the ear and pain and temporary or permanent hearing loss

- Interference with communication that would warn of danger.

Where noise levels are suspected of exceeding 80 dBA, noise measurements will be performed in accordance with “Controlling and Monitoring Exposure to Noise” (MCP-2719) for maintenance or operations and “Hearing Conservation” (PRD-2108) for construction personnel to determine if personnel

are routinely exposed to noise levels in excess of the applicable TWA (85 dBA for 8 hours of exposure or lower TWA for 10- or 12-hour work-shift exposures).

Personnel whose noise exposure routinely meet or exceed the allowable TWA will be enrolled in the INEEL Occupational Medical Program (OMP) (or subcontractor hearing conservation program as applicable). Personnel working on jobs that have noise exposures greater than 85 dBA will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection specified by the IH until directed otherwise.

2.3.3 Heat and Cold Stress

Project operational tasks will be conducted during times when there is a potential for both heat and cold stress that could present a potential hazard to personnel. The assigned IH or trained operations foreman is responsible for evaluating meteorological information to determine if additional heat or cold stress administrative controls are required. All construction, maintenance, and operations personnel must understand the hazards associated with heat and cold stress and take preventive measures to minimize the effects. "Heat and Cold Stress" (MCP-2704) guidelines will be followed for maintenance and operations tasks and "Heat and Cold Stress" (PRD-2107) for construction activities when determining work and rest schedules or when to halt work activities because of temperature extremes.

2.3.4 Ultraviolet Radiation Exposure

Personnel will be exposed to ultraviolet (UV) radiation (i.e., sunlight) when conducting project construction, maintenance, and operations outdoors. Sunlight is the main source of UV known to damage the skin and to cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. No UV rays or suntans are safe. The following are mitigative actions that should be taken to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long-sleeve or short-sleeve shirt [no tank tops])
- Apply a sunscreen with a sun protection factor of at least 15 to areas exposed to the sun
- Wear a hat (hard hat where required)
- Wear UV-absorbing safety glasses
- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m. whenever possible.

2.3.5 Confined Spaces

Work in confined spaces can subject personnel to risks involving engulfment, entrapment, oxygen deficiency, and toxic or explosive atmospheres. If confined spaces are identified at the Accelerated Retrieval Project site, they will be evaluated in accordance with "Confined Spaces" (MCP-2749) for operations and maintenance activities and "Confined Spaces" (PRD-2110) for construction tasks to determine if they are permit-required. If entry into identified project confined spaces is required, then all requirements of the applicable document will be implemented.

2.3.6 Biological Hazards

The project facilities and support buildings and structures provide habitat for various rodents, insects, and vectors (i.e., organisms that carry disease-causing microorganisms from one host to another). The potential exists for encountering nesting materials or other biological hazards and vectors. Hantavirus

may be present in the nesting and fecal matter of deer mice. If such materials are disturbed, it can become airborne and create a potential inhalation pathway for the virus. Contact and improper removal of these materials may provide additional inhalation exposure risks.

If suspected rodent nesting or excrement material is encountered, the assigned IH will be notified immediately and **no attempt will be made to remove or to clean the area**. Following an evaluation of the area, disinfection and removal of such material will be conducted in accordance with "Preventing Hantavirus Infection" (MCP-2750) for operations and maintenance activities and "Disease Control" (PRD-2102) for construction tasks.

Snakes, insects, and arachnids (e.g., spiders, ticks, and mosquitoes) also may be encountered at the project. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter. Protective clothing will generally prevent insects from direct contact with the skin. If potentially dangerous snakes or spiders are found or are suspected of being present, warn others, keep clear, and contact the assigned IH for additional guidance as required.

2.3.7 Inclement Weather Conditions

When inclement or adverse weather conditions develop that may pose a threat to persons or property at the project area (e.g., sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold), these conditions will be evaluated and a decision made by the HSO, IH, safety professional, RCT, and other operations personnel, as appropriate, to stop work, employ compensatory measures, or proceed with operations. The shift supervisor and operations personnel shall comply with INEEL MCPs and facility work control documents and design requirements that specify limits for project operations.

During all project activities, assigned health and safety professionals in consultation with RadCon and the shift supervisor will determine if wind or other weather conditions pose unacceptable hazards to personnel or the environment.

2.3.8 Lasers

The use of Class 1, 2, or 3a lasers for AR Project tasks is anticipated and will comply with the training, safe use, and exposure limit requirements of MCP-2717, "Laser Safety Program," for operations or maintenance activities, and PRD-2112, "Lasers," for construction. The use of Class 3b or greater lasers is not anticipated during AR project operations, maintenance, or construction, and must have IH review and concurrence prior to use, which shall comply with MCP-2717, "Laser Safety Program."

2.4 Other Project Hazards

Project personnel should continually look for potential hazards and immediately inform the HSO, shift supervisor, or other operations or construction lead personnel of the hazards so that action can be taken to correct the condition. All personnel have the authority to initiate STOP WORK actions in accordance with "Stop Work Authority" (MCP-553) for operations and maintenance personnel and "Stop Work Authority" (PRD-1004) for construction personnel if it is perceived that an imminent safety or health hazard exists or to take corrective actions within the scope of the work control authorization documents to correct minor safety or health hazards and then inform the shift supervisor, HSO, or lead person.

Personnel working at the project are responsible to use safe work practices; report unsafe working conditions, near misses, or acts; and exercise good housekeeping habits during project operations with respect to tools, equipment, and waste.

2.5 Site Inspections

The shift supervisor, IH, HSO, safety professional, RCT, subcontract technical representative, construction personnel, senior supervisory watch, and operations personnel may participate in project site inspections during the work control preparation stage of the project (e.g., the hazard identification and verification walk-downs) and conduct self-assessments or other inspections. Additionally, periodic safety inspections will be performed by the supervisors and assigned health and safety professionals in accordance with "Safety and Health Inspections" (MCP-3449).

Targeted or required self-assessments will be performed during project operations in accordance with "Performing Management Assessments and Management Reviews" (MCP-8) as directed by the operations manager or shift supervisor. All inspections and assessments will be documented and available for review by the shift supervisor, as a minimum. Health and safety professionals present during project operations may, at any time, recommend changes in work habits to the shift supervisor.

3. EXPOSURE MONITORING AND SAMPLING

The potential for exposure to chemical, radiological, and physical hazards exists during Accelerated Retrieval Project construction, maintenance, and operations and will affect all project personnel who are involved with overburden excavation, waste handling, sorting, storage, transporting, and decontamination activities. Enforcement of project area access requirements, work control zones (see Section 7), use of engineering and administrative controls, worker training, and wearing PPE provides the mitigation strategy for these hazards. Monitoring and sampling will be used throughout project operations to (1) assess the effectiveness of engineering controls, (2) determine the appropriate PPE requirements for individual tasks, and (3) determine the need for upgrading and downgrading of PPE as described in Section 5. Monitoring with direct-reading, stationary, and mobile instruments will be conducted to provide RadCon and Industrial Hygiene personnel with data to assess the effectiveness of control measures.

3.1 Airborne Exposure Engineering Controls

The Retrieval Enclosure and airlock structure are equipped with ventilation and particulate contamination suppression systems to minimize airborne COCs. The radiological and Industrial Hygiene support personnel will perform monitoring and sampling to determine the effectiveness of the engineering and administrative controls and adequacy of PPE. The Industrial Hygiene exposure assessments and monitoring data will be documented in the Hazards Assessment and Sampling System. Radiological data will be logged and maintained in accordance with the requirements in "Radiological Control Manual" (PRD-183).

3.1.1 Radiological Monitoring

Monitoring for radiological contamination and radiation will be conducted during all phases of the Accelerated Retrieval Project construction, operations, and maintenance using fixed and portable equipment. All project personnel will wear personal dosimetry as required on the RWP. The RCTs will collect and count air samples and smears as necessary to determine airborne and surface contamination levels. Portable or hand-held monitors will be used by RCTs to monitor radiation fields and contamination levels as determined necessary by Bechtel BWXT Idaho, LLC, RadCon. The radiation and contamination levels will be evaluated by the RCTs, RadCon foreman, RadCon supervisor, and radiological engineers as necessary to determine adequacy of the protective controls. Radiological monitoring equipment that might be used is included in Table 3-1.

3.1.2 Industrial Hygiene Monitoring

The Industrial Hygiene monitoring and sampling for nonradiological COCs will be performed by project Industrial Hygiene support personnel for either construction or operations, as appropriate. Monitoring will use direct-reading instruments, air-sampling equipment, environmental-monitoring equipment, and assessment techniques as determined appropriate by the IH based on professional judgment. The Industrial Hygiene equipment that may be used as determined appropriate by the IH is listed in Table 3-1.

Table 3-1. Monitoring instrument category and description.

Instrument Category	Instrument Category Number Description[a]
Radiological	Alpha: Count rate—Bicron NE Electra (DP-6 or AP-5 probe) or equivalent
	Stationary—Eberline RM-25 (HP-380AB or HP-380A probe) or equivalent
	Beta gamma: Count rate—Bicron NE Electra (DP-6, BP-17 probes) or equivalent. Stationary—Eberline RM-25 (HP-360AB probe) or equivalent
	Fissile material monitor
Radiological	Constant air monitor (alpha)—ALPHA 7-A-1 (inline and radial sample heads, pump, RS-485) or equivalent (as required)
	Constant air monitor (beta)—AMS-4 (inline and radial head, pump RS-485) or equivalent (as required)
	Grab sampler—Science Applications International Corporation H-810 or equivalent
Industrial hygiene	Organic vapor: Direct-reading instruments (photoionization detector, flame ionization detector, infrared detector, or other as determined by industrial hygienist), detector tubes or grab samples, or organic vapor monitor canisters or badges
	Dust: Direct-reading instrument (miniram)
Industrial hygiene	Organic vapors and other airborne constituents, particulate or hazardous atmospheres: personal sampling pumps with appropriate media for partial- and full-period sampling using National-Institute-for-Occupational-Safety-and-Health- or Occupation-Safety-and-Health-Administration-validated methods, direct-reading instruments, or remote-sensing detectors
Industrial hygiene	Silica dust, respirable: National Institute for Occupational Safety and Health 7500 or equivalent, personal sampling pump, 10-mm cyclone, full-period sampling
Industrial hygiene	Sound-level meter or dosimeter (A-weighted scale for time-weighed average dosimetry, C-weighted scale for impact-dominant sound environments)
Industrial hygiene	Observation and ergonomic assessment of activities in accordance with "Ergonomic Program " (MCP-2692)
Industrial hygiene	Heat stress: wet-bulb globe temperature, ambient temperature
	Cold stress: ambient air temperature, wind chill charts

a. Equivalent instrumentation other than those listed may be used.

3.2 Exposure Limits

Only controlled and authorized entry into the Retrieval Enclosure will be permitted after start of waste retrieval operations. Radiological Control and Industrial Hygiene personnel will conduct monitoring of project construction and operations with direct-reading instruments and stationary monitors, collect swipes, and conduct full- and partial-period air sampling, as deemed appropriate, in accordance with applicable TPRs, MCPs, and other guidelines. As new project processes or hazards are introduced, each will be evaluated and controlled in accordance with "Activity Level Hazard

Identification, Analysis, and Control" (PRD-25). Action limits should be adjusted as required based on changing site conditions, exposure mitigation practices, and PPE levels. Such changes will be reflected in applicable work control documents, permits, and procedures.

3.3 Environmental and Personnel Monitoring

The potential for exposure to radiological and nonradiological hazards exists during project construction and operations. All project personnel who handle, store, transport, and conduct disposal or decontamination activities will be protected from radiological and nonradiological contaminants to the extent feasible through the use of engineering controls, work controls, and PPE. However, the potential for exposure to these contaminants cannot be eliminated. Environmental and personnel monitoring will be conducted to determine the effectiveness of these exposure control practices and assist health, safety, and radiological professionals in establishing additional administrative controls and PPE requirements.

3.3.1 Industrial Hygiene Area and Personal Monitoring and Instrument Calibration

The assigned Accelerated Retrieval Project IH will conduct full- and partial-period sampling of airborne contaminants and monitoring of physical agents during operations at a frequency deemed appropriate based on direct-reading instrument readings and changing conditions. When performed, all air sampling will be conducted using applicable National Institute of Occupational Safety and Health (NIOSH), OSHA, or other validated method. Both personal and area sampling and remote-sensing monitoring may be conducted.

Various direct-reading instruments may be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by Accelerated Retrieval Project conditions, direct-reading instrument results, observation, professional judgment, and in accordance with the "Industrial Hygiene Exposure Assessment" (MCP-153).

All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing Industrial Hygiene protocol, and in conformance with "Control of Measuring and Test Equipment" (MCP-2391) and the companywide safety and health manuals, *Safety and Health—Occupational Safety and Fire Protection* (Manual 14A) and *Safety and Health—Occupational Medical and Industrial Hygiene* (Manual 14B). Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded as stated in Section 12.

3.3.2 Radiological Monitoring and Instrument Calibration

Radiological instrumentation to be used during Accelerated Retrieval Project operations will include alpha- and beta-gamma equipment as identified by RadCon personnel. The personal contamination monitors (PCMs) for automated whole-body survey will be located at normal egress points. Additionally, scalers, high-volume samplers, lapel samplers, and other instrumentation will be available to collect and quantify radiological contamination levels.

In addition to routine radiological monitoring and sampling instruments and equipment, other instrumentation provided for project operations includes the fissile material monitor system.

Radiological monitoring of radiation and contamination will be conducted during Accelerated Retrieval Project construction and operations to ensure that personnel are given adequate protection from potential radiological exposure. Instruments and sampling techniques listed in Table 3-1 may be used by the RCT as deemed appropriate and as required by general or task-specific RWPs. When conducted,

monitoring will be performed in accordance with *Radiation Protection Procedures* (Manual 15B) and *Radiological Control Procedures* (Manual 15C). The data obtained from monitoring will be used by RadCon personnel to evaluate the effectiveness of project engineering controls and decontamination methods and procedures and to alert personnel to potential radiation or contamination sources.

All portable survey instruments will be source-checked daily to ensure they are within the specified baseline calibration limits. Accountable radioactive sources will be maintained in accordance with "Radioactive Source Accountability and Control" (MCP-137). All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations, existing RadCon protocol, *Radiation Protection Procedures* (Manual 15B), and "Health Physics Instrumentation" (MCP-93).

3.3.3 Personnel Radiological Exposure Monitoring

Personal radiological monitoring will be conducted during Accelerated Retrieval Project construction and operational activities to quantify radiation exposure and potential for uptakes as stated in the general or task-specific RWP. This will include the use of external dosimetry, surface monitoring, and internal dosimetry methods to ensure that engineering controls, administrative controls, and work practices are effectively mitigating radiological hazards. General as-low-as-reasonably-achievable (ALARA) considerations are discussed further in Section 4.4.

3.3.3.1 External Dosimetry. Dosimetry requirements will be based on the radiation exposure potential during Accelerated Retrieval Project operations. All personnel who enter project construction or operational areas will be required to wear a minimum of a thermoluminescent dosimeter (TLD) and other personal dosimetry devices (e.g., albedo dosimetry) specified by RadCon personnel in applicable RWPs and in accordance with the "Radiological Control Manual" (PRD-183).

The Radiological Control and Information Management System (RCIMS) will be used to track external radiation exposures to project personnel and to serve as the administrative control mechanism for working in accordance with individual RWPs. Individual project personnel are responsible for ensuring all required personal information is provided to RadCon personnel for entry into RCIMS and logging in when electronic dosimeters are used.

3.3.3.2 Internal Monitoring. The purpose of internal dose monitoring is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes that may occur. Internal dose evaluation programs will be adequate to demonstrate compliance with "Occupational Radiation Protection" (10 CFR 835). The requirement for whole-body counts, lung counts, and bioassays will be based on specific Accelerated Retrieval Project construction and operational evaluations conducted by the assigned radiological engineer. Select project personnel will be entered into a plutonium bioassay program based on the hazards associated with individual job functions. Bioassay requirements will be specified on the RWP, and project personnel will be responsible for submitting required bioassay samples upon request.

4. ACCIDENT AND EXPOSURE PREVENTION

The Accelerated Retrieval Project construction and operations will present numerous safety, physical, chemical, and radiological hazards to personnel conducting these activities. It is critical that all personnel understand and follow the requirements of this HASP. Project facility design features, engineering controls , hazard isolation, specialized work practices, and the use of PPE will be in place to eliminate or mitigate all potential hazards and exposures. However, given the nature of the Accelerated Retrieval Project scope and the waste material being excavated, all hazards cannot be eliminated. Personnel are responsible for the identification and control of hazards in their respective project work areas in accordance with Integrated Safety Management System (ISMS) principals and practices.

Note: Hazards will not be left unmitigated without implementing some manner of controls or abatement (e.g., engineering controls, administrative controls, or the use of PPE).

Personnel should use stop work authority in accordance with "Stop Work Authority" (MCP-553) or "Stop Work Authority" (PRD-1004) as appropriate and where it is perceived that imminent danger to personnel, equipment, or the environment exists.

This HASP is to be used in conjunction with "Activity Level Hazard Identification, Analysis, and Control" (PRD-25) and Accelerated Retrieval Project work authorization and control documents, such as "Integrated Work Control Process" (STD-101) work orders, JSAs, "Hazard Identification, Analysis, and Control of Operational Activities" (MCP-3562), and operational TPRs. Where appropriate, "Hazard Identification, Analysis, and Control of Operational Activities" (MCP-3562) and "Hazard Mitigation Guide for Integrated Work Control Process" (GDE-6212) mitigation guidance will be incorporated into applicable work controls, JSAs, and RWPs.

4.1 Voluntary Protection Program and Integrated Safety Management System

Project operations will incorporate Voluntary Protection Program (VPP) and ISMS criteria, principles, and concepts to identify and mitigate hazards, thereby preventing accidents. All management and workers are responsible for implementing safety policies and programs and for maintaining a safe and healthful work environment. Personnel will take a proactive role in preventing accidents, ensuring safe working conditions for themselves and fellow personnel, and complying with all work control documents, procedures, and permits.

The **ISMS** is focused on the **system** side of conducting operations, and **VPP** concentrates on the **people** aspect of conducting work. Both programs define work scope, identify and analyze hazards, and mitigate the hazards. The INEEL and its subcontractors participate in VPP and ISMS. This Accelerated Retrieval Project HASP includes all elements of both systems. The five key elements of VPP and ISMS and their corresponding HASP sections are as shown in Table 4-1.

Table 4-1. Five key elements of the Voluntary Protection Program and Integrated Safety Management System and corresponding sections of the health and safety plan.

Voluntary Protection Program	Integrated Safety Management System	Project Health and Safety Plan Section
Work site analysis	Define work scope	Section 1
	Analyze hazards	Sections 2, 3, 5, and 8
Hazard prevention and control	Develop and implement controls	Sections 2, 3, 4, 5, 7, 10, and 11
Safety and health training	Perform within work controls	Section 6
Employee involvement		Sections 2, 3, and 4
Management leadership	Provide feedback and improvement	Sections 6 and 9

4.2 General Safe Work Practices

The following general safe work practices are mandatory for all personnel to reduce the likelihood of accidents, injuries, and exposures. In addition, all visitors permitted to enter Accelerated Retrieval Project operational work areas must follow these requirements. Failure to follow these practices may result in permanent removal from the Accelerated Retrieval Project and other disciplinary actions. The RWMC shift supervisor in conjunction with HSO and assigned health and safety and RadCon personnel will be responsible for ensuring the following safe work practices are adhered to during project construction and operations:

- Limit access to project construction and operations areas to authorized personnel only.
- Personnel must be aware of and comply with all safety signs, tags, barriers, and color.
- Be familiar with the physical characteristics of the Accelerated Retrieval Project facilities and requirements, including, but not limited to, the following:
    - Layout of the Accelerated Retrieval Project controlled areas and egress routes.
    - Project waste types, labeling, and storage requirements.
    - Facility safety-significant structures, systems, and components; technical safety requirements; and limiting conditions of operation as applicable to the work to be performed and areas accessed.
    - Facility and RWMC warning devices and alarms.
    - Communications with the RWMC shift supervisors.
    - Major SDA roads and means of access to and from the Accelerated Retrieval Project.
    - Location of facility emergency response equipment and first-aid supplies.
- Be alert for dangerous situations (e.g., facility alarms, spills, accidents, and injuries) and report dangerous situations and near misses to the shift supervisor. The shift supervisor will make required notification in accordance with Section 10.

- Provide adequate information to the oncoming shift personnel, including equipment and system status and inspection logs, and communicate all systems, monitors, and safety components that are nonoperational and ensure they are tagged as to their appropriate status (e.g., "Out of Service" or "Do Not Use").

- Plan and review all operational tasks before initiating the activity. Verify all work control documents (e.g., the RWP, JSA, TPR, or work order) are current and correct for the activity. A prejob briefing is required to be conducted for all activities in accordance with "Performing Pre-Job Briefings and Documenting Feedback" (MCP-3003).

- Conduct all construction and operations in accordance with the applicable TPR or work order. All activities will be conducted as stated in the applicable work control document including hold points and requirements for initials upon completion of certain steps (Use Type 1 TPR only) or work orders. Use Type 2 TPRs will be followed in a step-by-step sequence.

Note: It is the responsibility of all personnel to identify, understand, and follow the appropriate work controls for their operational activities.

- All personnel shall have the authority to initiate STOP WORK actions in accordance with "Stop Work Authority" (MCP-553) or "Stop Work Authority" (PRD-1004) as appropriate.

- Personnel shall be familiar with tools and equipment for which they are responsible to operate including operating limitations, maintenance, inspection, and manufacturer's operating instructions requirements. Tools and equipment shall only be used for their intended use.

- Understand the PPE requirements for all tasks as stated on the applicable TPR, JSA, RWP or work order. This includes the proper use and limitation of all PPE. If questions arise about PPE, contact the assigned IH, safety professional, or RCT as applicable.

- Personnel must wear all required dosimetry as stated on the RWP. This includes any supplemental dosimetry (e.g., electronic dosimeters and albedo dosimeters). Respond to all radiological alarms including, but not limited to, constant air monitors, criticality system, radiation, and PCM alarms.

- Avoid direct contact with waste material or containers. Personnel shall not walk through spills or other areas of contamination and shall avoid kneeling, leaning, or sitting on equipment or surfaces that may be contaminated.

- Personnel shall not eat, drink, chew gum or tobacco, smoke, apply cosmetics or sunscreen, or perform any other practice that increases the probability of hand-to-mouth transfer and ingestion of materials in project operations areas, except within designated administrative break areas and only after having completed required contamination surveys. Drinking water may be permitted in areas specified and controlled in accordance with RadCon and IH approval.

- Practice good housekeeping at all times. Turn in or place tools in the designated storage location after use. Put waste materials in the appropriate waste container or receptacle. If there is a question as to where to dispose of a waste article, personnel should ask the supervisor or the shift supervisor.

4.3 Subcontractor Responsibilities

Where subcontractors are used to support project construction or operations, subcontractors are responsible for meeting all applicable INEEL MCP, program requirements document, VPP, and ISMS flow-down requirements, such as those listed on "Subcontractor Requirements Manual (SRM) Applicability" (Form 540.10), *Subcontractor Requirements Manual* (TOC-59), and contract general and special conditions. Additionally, subcontractors are expected to take a proactive role in hazard identification and mitigation while conducting operational support tasks. Subcontractors will report unmitigated hazards to the Accelerated Retrieval Project subcontractor technical representative (STR) or RWMC shift supervisor after taking protective actions (within the documented work controls) and emergency protective actions, if necessary.

4.4 Radiological and Chemical Exposure Prevention

Where entry into contaminated areas is required, chemical, radiological, and physical hazards will be mitigated through the use of engineering controls, work procedures and hold points, area and personnel monitoring, and PPE where possible or to minimize exposure potential. All personnel are responsible for understanding the hazard identification and mitigation measures necessary to prevent or reduce exposures. This section presents radiological and chemical exposure prevention strategies for use where engineering controls are not feasible and as good work practices.

4.4.1 Radiological Exposure Prevention—As Low as Reasonably Achievable Principles

The radiation exposure of personnel will be controlled such that exposures are well below regulatory limits established in "Occupational Radiation Protection" (10 CFR 835) and that no radiation exposure occurs without commensurate benefit. All personnel have the responsibility for following ALARA principles and practices.

Note: Unplanned and preventable exposures are considered unacceptable.

The Accelerated Retrieval Project shall establish work controls that will ensure that personnel are adequately protected from known sources of radiation in project areas. The issuance of RWPs, establishment and posting of radiological controlled areas, and review of activities by the RWMC ALARA committee will form the basis for controlling exposure to ionizing radiation during project construction and operations. Personnel working at the Accelerated Retrieval Project must strive to keep both external and internal radiation doses ALARA by adopting the practices in the following sections.

4.4.1.1 External Radiation Dose Reduction. The RWPs written for project construction and operations will define radiological hold points, required dosimetry, RCT coverage, radiological controlled areas, and radiological limiting conditions in accordance with "Radiological Work Permit" (MCP-7). Radiological Control personnel will participate in the prejob briefing required by "Performing Pre-Job Briefings and Documenting Feedback" (MCP-3003) to ensure all personnel understand the dose-rate limits and limiting conditions on the RWP. All personnel will be required to read and acknowledge the RWP requirements before being allowed to sign the RWP (or scan the RWP bar code in RCIMS) and obtain electronic dosimetry.

Basic ALARA protective measures used to reduce external doses include (1) minimizing time in radiation areas, (2) maximizing the distance from known sources of radiation, and (3) using shielding whenever possible. Specific examples of these methods are provided in the following subsections.

4.4.1.1.1 Methods for Minimizing Time in Radiation Areas—

Personnel will incorporate the following methods for minimizing time in radiation areas:

- Preplan all work activities and conduct dry runs where necessary to validate procedures and equipment functional testing
- Plan and discuss the tasks before entering a radiation area (including having all equipment and tools prepared)
- Perform as much work as possible outside radiation areas and take advantage of lower dose-rate areas (as shown on the radiological survey maps)
- Take the most direct route to the task area and work efficiently
- Hold technical discussions outside radiation areas if problems occur in the radiation areas, and then return to the work area to complete the task
- Know stay time and use appropriate signal and communication method to inform others in the area when the stay time is up, if stay times are required
- Respond to electronic dosimetry alarms by notifying others in the area and the RCT, and exit the radiation area through the designated entry and exit point
- Know individual current dose and dose limit.

Note: If RCIMS indicates an individual is approaching or has exceeded the dose limit, the RCT should be notified immediately and the worker should not proceed into the radiation work area.

4.4.1.1.2 Methods for Maximizing Distance from Radiation Sources—

Personnel will incorporate the following methods for maximizing the distance from radiation sources:

- Use remote-operated equipment or controls where available
- Stay as far away from the source of radiation as possible (extremely important for point sources where, in general, if the distance between the source is doubled, the dose rate falls to one-fourth of the original dose rate)
- Become familiar with the radiological survey map for the project area where work will be performed, as well as high and low dose-rate locations, and take advantage of low dose-rate areas.

4.4.1.1.3 Proper Use of Shielding—

Personnel will incorporate the following methods for the proper use of shielding as a protective measure used to reduce external radiation doses:

- Know what shielding is required and how it is to be used for each radiation source
- Take advantage of the equipment and enclosures for shielding from radiation sources
- Verify interlocks are functional and use shielding when operating drum assay equipment
- Wear safety glasses to protect eyes from beta radiation.

4.4.1.2 *Internal Radiation Dose Reduction.*

The most significant internal radiation dose potential exists during entry into the Retrieval Enclosure during waste excavation. An internal dose is a result of radioactive material being taken into the body. Radioactive material can enter the body through inhalation, ingestion, absorption through wounds, or injection from a puncture wound. Reducing the potential for radioactive material to enter the body is critical to avoid an internal dose. The following are methods to minimize the hazard of an internal radiation dose:

- Preplan all work activities and conduct dry runs where necessary to validate procedures and equipment functional testing
- Verify samplers are functional before entry into contamination or airborne radioactivity areas
- Review the RadCon survey map for areas of known contamination and potential high-contamination sources and minimize or avoid activities in those areas (where possible)
- Wear protective clothing and respiratory protection as identified on the RWP, perform all respirator leak checks, and inspect all PPE before entering contaminated areas or areas with airborne radioactivity
- When inside contaminated areas, do not touch your face (adjust glasses or PPE) or other exposed skin
- Respond to all alarms or other indications of increased contamination levels (RCT directions)
- When exiting contaminated areas, follow all posted instructions and remove PPE in the order prescribed (if questions arise, consult RadCon personnel)
- Conduct whole-body personnel survey when exiting the contaminated area, then proceed directly to the PCM
- Report all wounds or cuts (including scratches and scrapes) before entering radiologically contaminated areas
- Wash hands and face before eating, drinking, smoking, or engaging in other activities that may provide a pathway for contaminants.

Monitoring for radiation and contamination during project tasks will be conducted in accordance with the RWP, "Radiological Control Manual" (PRD-183), *Radiation Protection Procedures* (Manual 15B), and *Radiological Control Procedures* (Manual 15C) and as deemed appropriate by RadCon personnel.

4.4.2 Chemical and Physical Hazard Exposure Avoidance

The primary potential for exposure to nonradiological contaminants is the same as the radiological sources. Additionally, chemicals (e.g., fuels, lubricants, and cleaners) will be used in support of project construction and operations. A material safety data sheet (MSDS) is required to be available for all chemicals used in accordance with "Hazard Communication" (MCP-2715) for operations and maintenance or "Hazard Communication" (PRD-2101) for construction. All chemicals entering the Accelerated Retrieval Project facility must be entered into and tracked using the INEEL Chemical Management System. The INEEL Chemical Management System is used for maintaining and tracking the inventory of chemical containers, and its basic functionality includes the following:

- Identify container
- Track the location and location changes of a container
- Define the contents of a container at any point in time
- Record distributions into and out of a container
- Record distributions to a waste stream
- Provide a running inventory based on the distributions entered
- Produce regulatory reports from the data entered
- Calculate conversions from one unit of measure to another
- Define container update authorization for a location
- Provide flexibility in how to manage chemicals.

Note: Project waste streams are not considered chemicals for purposes of entry into INEEL Chemical Management System.

Threshold limit values or other occupation exposure limits have been established for numerous chemicals and physical agents (e.g., noise, heat, or cold stress) that may be encountered. These exposure limits provide guidelines in evaluating airborne, skin, and physical agent exposures. The TLVs represent levels and conditions under which it is believed that nearly all workers may be exposed day after day without adverse health effects. The TLV TWA is a TWA concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects. Action limits will be utilized as applicable to further reduce the likelihood of exceeding TLVs or as regulatory triggers for additional medical surveillance and actions. These concentrations for nonradiological COCs are provided in Table 2-3.

4.5 Buddy System

The two-person or buddy system will be used during Accelerated Retrieval Project operations for entries into the exclusion zone (Retrieval Enclosure) and contamination reduction corridor (Airlock One service bays), as described in section 7. The buddy system is most often used during operational activities requiring the use of protective clothing and respiratory protection where heat stress, contaminant exposure, and other hazards may impede a person's ability to self-rescue. The buddy system requires each employee to assess and monitor his or her buddy's mental and physical well being during the course of the operation. Operations will implement the buddy system as follows:

- The equipment operators entering the Exclusion Zone (Retrieval Enclosure) in the telehandler forklift and excavator will be continuously monitored through radio communications and visual observation by an assigned buddy located outside the Retrieval Enclosure. This buddy must have direct communications with the operator and maintain visual oversight of the operator/equipment at all times to observe and detect any signs of disorientation or confusion that could indicate a potential problem. The buddy assigned to monitor the equipment operator's condition must have immediate access to communications (i.e., radio, cell phone, telephone) for summoning emergency

assistance if required. A single buddy may be assigned to observe both the telehandler and excavator operators, provided the buddy can maintain radio communication and visual observation of both. If the buddy directs the equipment operator to exit from the Exclusion Zone for any reason, both the excavator and telehandler equipment operators will proceed to Airlock One and exit using normal process unless an emergency exit is required.

- Personnel entering into the Contamination Reduction Corridor (Airlock One Service Bays) or Exclusion Zone (Retrieval Enclosure) but not operating the excavator or telehandler forklift will enter the areas in pairs or assigned groups (e.g., three-person group). The buddies will maintain communication and visual contact with the other entrants at all times to provide assistance if required, verify integrity of PPE, observe his or her buddy for signs of disorientation or confusion, and summon assistance if required. If a buddy instructs an exit from the area for any reason, the buddy will comply with this instruction and leave the area utilizing normal exit process unless an emergency exit is required.

5. PERSONAL PROTECTIVE EQUIPMENT

Radiological, chemical, and physical hazards will be encountered in conjunction with routine construction and operational activities as presented in Section 2. Where hazards cannot be eliminated through engineering or administrative controls, PPE will be used to protect personnel.

Project operations personnel and visitors who enter the project construction and operational areas must be protected against potential safety, health, and radiological hazards. The requirements in "Activity Level Hazard Identification, Analysis, and Control" (PRD-25) will be used to evaluate all activities and define the appropriate PPE for all operational activities and areas in accordance with "Personal Protective Equipment" (29 CFR 1910, Subpart I) hazard assessment requirements. This section provides guidance for the section and use of PPE to be worn for project construction and operations, and contingencies for upgrading or downgrading PPE. The actual PPE requirement for specific Accelerated Retrieval Project operational tasks will be specified in applicable JSAs, TPRs, work packages, SWPs, or RWPs.

The purpose of PPE is to shield or isolate personnel from radiological, nonradiological, physical, and biological hazards that cannot be eliminated though engineering or other controls. It is important to realize that no single PPE ensemble can protect against all hazards under all conditions and that proper work practices and adequate training will serve to augment PPE to provide the greatest level of protection to workers. The PPE will be selected, issued, used, and maintained in accordance with "Personal Protective Equipment" (PRD-5121) for operations and maintenance and "Personal Protective Equipment" (PRD-2001) for construction. Radiological anticontamination clothing requirements will be developed in accordance with "Radiological Personal Protective Equipment"(MCP-432) and listed on the RWP.

The PPE is generally divided into two broad categories: (1) respiratory protective equipment and (2) personal protective clothing. Table 5-1 provides guidance in the selection process for respiratory and protective clothing. Listed PPE levels may be augmented by SWP- or RWP-specific requirements. Project construction and operations will be evaluated by IH, Industrial Safety, and RadCon to determine the most appropriate PPE levels and any modifications required. Potential exposures and hazards associated with project activities will be monitored (as discussed in Section 3) during the course of the project to evaluate changing conditions and to determine PPE level adequacy and the need for modifications.

Table 5-1. Respiratory and protective clothing selection guidance.

Hazard	Level of Protection
Respiratory Personal Protective Equipment Selection[a]	
Not IDLH or oxygen-deficient atmospheric conditions. Gaseous, vapor, particulate, and aerosol chemicals or radionuclides.	Level C—full-face piece, as determined by the industrial hygienist or radiological control technician. The high-efficiency particulate air and chemical combination cartridge for concentrations up to the protection factor of an air-purifying full-face piece respirator and within the assigned derived air concentration[b] value. Level B—full-face piece, supplied air respirator or air hood (bubble hood).
IDLH or oxygen-deficient atmospheric conditions. Gaseous, vapor, particulate, and aerosol chemicals or radionuclides.	Level B—full-face piece, supplied air respirator with an escape-only self-contained breathing apparatus or Level A—Self-contained breathing apparatus.

Table 5-1. (continued).

Hazard	Level of Protection
Protective Clothing Selection	
Low atmospheric-contaminant levels that are present under stable conditions. No anticipated immersion, splashes, or potential for unexpected contact with radiological or nonradiological contaminants.	Level D.
Moderate atmospheric contaminants under relatively stable conditions; liquid splashes or other direct contact that do not have corrosive characteristics or can be absorbed by exposed skin. Low-radionuclide contamination and airborne radioactivity levels.[c]	Level C.
Moderate-to-high atmospheric contaminants under unstable conditions; potential for contact with wet contaminated surfaces and material that can saturate or permeate Level C protective clothing. Moderate radionuclide contamination and airborne radioactivity levels.[c]	Level B.
High and unknown atmospheric contaminants; potential for contact with substances that pose a high hazard potential to the skin; high potential for splash, immersion, or exposure to unexpected vapor, gas, aerosol, or dust that might present an IDLH situation and be readily absorbed through the skin. High-radionuclide contamination and airborne radioactivity levels.[c]	Level A[d] (not anticipated).

a. A high-efficiency particulate air or multichemical and high-efficiency particulate air combination cartridge may be selected by industrial hygienist and Radiological Control personnel based on specific hazards
b. Derived air concentration based on specific radionuclides
c. Contamination levels and airborne radioactivity as defined by "Radiological Areas and Radioactive Material Areas" (10 CFR 835.603[d] 9)
d. Level A personal protective equipment is not anticipated to be required for personnel conducting project operations.

IDLH = immediately dangerous to life or health

5.1 Respiratory Protection

The primary objective will be to prevent or significantly reduce inhalation of potential toxic substances. The Retrieval Enclosure design and planned operational approach for the Accelerated Retrieval Project require the use of supplied air respiratory protection for waste excavation operations in the Retrieval Enclosure during waste excavation in accordance with "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120). This requirement will be evaluated by IH and RadCon to

determine appropriateness if additional information becomes available or is developed during the project operations.

Supplied air respiratory protection also will be required in all high-contamination areas as documented on the RWP, TPR, or JSA. The level and type of respiratory protection for other Accelerated Retrieval Project operational or construction activities and areas will be as determined by IH, RadCon, and Industrial Safety and will be documented in the TPR, work order, JSA, RWP, or SWP. Assigned protection factors for respiratory devices are listed in Appendix B of "Respiratory Protection" (MCP-2726).

All personnel required to wear respirators shall complete training and be fit tested before being assigned a respirator. Requirements for respirator use, emergency use, storage, cleaning, and maintenance, as stated in "Respiratory Protection" (MCP-2726) for operations and "Respiratory Protection" (PRD-2109) for construction, shall be followed.

5.2 Personal Protective Equipment Levels

The following sections provide general guidance on typical hazardous waste operations and emergency response (HAZWOPER) levels of PPE. Project operational activities will be evaluated to determine the most appropriate PPE, which may or may not incorporate traditional HAZWOPER levels. When required to be worn, PPE requirements will be specified on applicable TPRs, work orders, JSAs, RWPs, or SWPs.

Table 5-2 lists PPE items typically included for three traditional HAZWOPER levels of PPE. These PPE-level ensemble requirements will be determined by assigned project safety and health professionals in consultation with RadCon personnel based on the hazards presents, monitoring results, and nature of the operational task. Modifications to PPE levels will be made based on changing operational conditions and monitoring results. Such modifications are routinely employed to maximize efficiency and to meet operational-specific needs without compromising personnel safety and health.

Table 5-2. Levels and options of personal protective equipment.

PPE Level	Personal Protective Equipment Required[a]	Optional Personal Protective Equipment or Modifications
D	Coveralls or standard work clothes (coverall material type based on IH determination). Hardhat (based on task-specific overhead hazards as required by Industrial Safety) meeting "Safety Requirements for Industrial Head Protection" (ANSI Z89.1-1969). Eye protection based on task-specific hazards (safety glasses meeting "Practice for Occupational and Educational Eye and Face Protection" [ANSI Z87.1-1968] requirements as a minimum). Hand protection (material based on type of work and hazardous materials being handled). Safety toe boots (steel or protective toe) meeting "Men's Safety-Toe Footwear" (ANSI Z41.1-1967) requirements for all operations and maintenance personnel. Sturdy leather or substantial footwear above the ankle for visitors, nonworkers, and construction tasks.	Chemical or radiological protective clothing (Tyvek or Saranex) by IH or RCT. Chemically resistant hand and foot protection (e.g., inner and outer gloves and boot liners). Radiological modesty garments under outer protective clothing (as required by the RWP). Any specialized protective equipment (e.g., hearing protection, cryogenic gloves, face shields, welding goggles, and aprons).

Table 5-2. (continued).

PPE Level	Personal Protective Equipment Required[a]	Optional Personal Protective Equipment or Modifications
C	Level D ensemble with the following respiratory and whole-body protection upgrades:[b] • Full-face piece air-purifying respirator equipped with a National-Institute-of-Occupational-Safety-and-Health-approved HEPA filter or chemical and HEPA combination cartridge (IH to specify cartridge type) • Standard Tyvek (or equivalent) coverall. OR • Chemical-resistant coveralls (e.g., Tyvek QC, Tychem 7500, or Saranex-23-P) (IH to specify material).	Chemical-resistant outer shoe or boot cover (IH or RCT to specify material). Inner chemical-resistant gloves with cotton liners (as determined by the IH and RWP). Outer chemical-resistant gloves (as determined by the IH). Radiological modesty garments under outer protective clothing (as required by RWP). Any specialized protective equipment (e.g., hearing protection, welding lens, and aprons). (Safety glasses not required if wearing a full-face respirator.)
B	Level C ensemble with the following respiratory and whole-body protection upgrades:[b,c] • Supplied breathing air system full-face respirator or bubblehood . OR (for immediately-dangerous-to-life-or-health environment) • Full-face piece supplied air respirator with a 10-minute escape bottle . OR • Self-contained breathing apparatus. AND • Chemical-resistant coveralls or encapsulating suit (Tyvek QC, Tychem 7500, Saranex 23-C, or equivalent).[d] • Any other chemical or radiological personal protective equipment prescribed in site-specific RWP or safe work permit. • Chemical-resistant butyl or one-time-use natural latex outer boots (as determined by the IH and RWP). • Inner chemical-resistant gloves with cotton liners (as determined by the IH and RWP). Outer chemical-resistant Viton or polyvinyl alcohol gloves (as determined by the IH). Note: All seams must be taped and secured to prevent skin contact from hazardous substances in a soil, liquid, mist, or aerosolized form.	Chemical-resistant outer shoe or boot cover (IH or RCT to specify material). Radiological modesty garments under outer protective clothing (as required by RWP). Any specialized protective equipment (e.g., hearing protection, welding lens, and aprons).
A	Not anticipated for Accelerated Retrieval Project operations.	Not anticipated for Accelerated Retrieval Project operations.

a. The personal protective equipment ensemble may be modified by the IH or RCT to provide protection from skin or other physical hazards.
b. Upgrades are determined by the IH in conjunction with other environment, safety, and health professionals.
c. Level B and A work will require approval from the project operations manager .
d. Supplied air respirator hose length no more than manufacturer's specification and under no circumstances greater than 91.4 m (300 ft).

HEPA = high-efficiency particulate air
IH = industrial hygienist
PPE = personal protective equipment
RCT = radiological control technician
RWP = radiological work permit

Note: Personnel must inspect all PPE before donning and entry into any work area. Items found to be defective or that become unserviceable during use will be doffed and disposed of in accordance with posted procedures and placed into the appropriate waste stream.

5.3 Operations Personal Protective Equipment

Accelerated Retrieval Project operations will utilize PPE including anti-contamination clothing and respiratory protection to minimize personnel exposure to the contaminants of concern. The level of protection required will depend on the contamination levels detected and tasks being performed. The IH, RadCon, and Safety professionals will evaluate tasks to be performed and specify the appropriate level of PPE to be utilized. The following information will be used as a guide for selecting the required PPE.

- Personnel working in the operations Support Zone outside of WMF-697 and the Contamination Reduction Zone inside Airlocks One and Two will wear modified Level D PPE including a minimum of standard work clothing, safety toe boots, and gloves for material handling tasks. Hard hats and safety glasses will be required as specified in work control documentation for specific activities. Personnel performing liquid nitrogen handling will wear the required cryogenic PPE as a minimum including a face shield, safety glasses with side shields, safety toe boots extending above the ankle, cuffless pants that overlap the boots, full length sleeved shirt, and cryogenic gloves that overlap the shirt sleeves. Additional PPE may be required for radiological work as specified in the RWP.

- Personnel entering the Contamination Reduction Corridor inside WMF-697 will wear either Level C or Level B PPE based on actual contamination levels and activities being performed and specified in the applicable work control documentation. The Level C PPE includes anti-contamination clothing specified in the RWP with a full-face air-purifying respirator equipped with a combination cartridge for particulates and organic compounds. The level B PPE includes anti-contamination clothing specified in the RWP with a full-face respirator or bubble hood supplied air system for respiratory protection.

- Personnel not inside the retrieval equipment, but entering the Exclusion Zone inside the WMF-697 Retrieval Enclosure will wear level B PPE including anti-contamination clothing per the RWP and supplied air respiratory protection. The respiratory protection selected will be documented in the work control documentation and RWP and will be based on the measured contamination levels, tasks to be performed, duration of the entry, and location of the entry.

- The equipment operators in the excavator and the telehandler forklift entering the Exclusion Zone inside the WMF-697 Retrieval Enclosure will wear level B PPE including anti-contamination clothing and a full-face supplied air respirator.

5.4 Personal Protective Clothing Upgrading and Downgrading

The assigned IH, Industrial Safety, and RadCon personnel will be responsible for determining when to upgrade or downgrade PPE requirements. Upgrading or downgrading of PPE is based on changing operational conditions (e.g., equipment, waste types, and location of tasks) and is a normal occurrence. If changing conditions are encountered, work control documents (e.g., work order, RWP, and JSA) may need to be updated to reflect these changes or augmented by an SWP. Additional reasons for upgrading or downgrading are listed in the following subsections.

5.5 Inspection of Personal Protective Equipment

All PPE ensemble components must be inspected before use and when in use during Accelerated Retrieval Project construction and operations in accordance with "Personal Protective Equipment" (PRD-5121) for operations or "Personal Protective Equipment" (PRD-2001) for construction activities. Once PPE is donned, self-inspection will serve as the principal form of inspection. If PPE should become damaged or degradation or permeation is suspected, the individual wearing the PPE will inform others of the problem and proceed directly to the work-area exit point. Following required surveys (as required), PPE will be doffed and replaced. In addition, all PPE that becomes grossly contaminated or presents a potential source for the spread of such contamination will be required to be decontaminated or replaced.

Table 5-3 provides a general inspection checklist for common PPE items. Not all PPE ensemble items listed may be required for Accelerated Retrieval Project construction or operational tasks. Where specialized protective clothing or respiratory protection is used or required, the manufacturer's inspection requirements in conjunction with regulatory or industry inspection practices will be followed. The assigned IH, safety professional, or RCT should be consulted about specific PPE inspection criteria.

Table 5-3. Inspection checklist for personal protection equipment.

Personal Protection Equipment Item	Inspection
Respirators (full-face piece air-purifying and supplied air respirators with escape-only self-contained breathing apparatus bottles)	Before use: • Verify that respirator is within 3 years of shelf life • Ensure airline matches the airline respirator to be used • Inspect airline hose connections (sections of hose) to ensure all are threaded or permanent metal-to-metal connections or quick disconnects per the manufacturer's requirements and as approved in MCP-2726 "Respiratory Protection", Appendix F. • Check condition of the face piece, head straps, valves, connecting lines, fittings, and all connections for tightness • Check cartridge to ensure proper type or combination is being used for atmospheric hazards to be encountered, and inspect threads and O-rings for pliability, deterioration, and distortion • Check for proper setting and operation of regulators and valves, check all hose connections back to the breathing-air compressor, and check the pressure to the airline station and on individual airline connections to ensure pressure is within required range (in accordance with the manufacturer's specifications). Before entry into Level B area: • Ensure air compressor is providing adequate airflow when all personnel have airlines hooked up to the compressor manifold in accordance with "Respiratory Protection" (MCP-2726).

Table 5-3. (continued).

Personal Protection Equipment Item	Inspection
Air hoods	Before use: • Ensure airline matches the air hood to be used • Visually inspect all seams and surfaces for tears and cracks • Pressurize air hood to check for pinholes or defective seams (no air should leak out when choking clear hood piece). Before entry into contaminated area: • Inspect all airline connections for tight fit (pull connections three times) • Ensure air compressor is providing adequate airflow when all personnel have airlines hooked up to the compressor manifold.
Level D, C, and B clothing	Before use: • Visually inspect for imperfect seams, nonuniform coatings, and tears • Hold personal protective equipment up to the light and inspect for pinholes, deterioration, stiffness, and cracks. While wearing in the work zone: • Inspect for evidence of chemical attack such as discoloration, swelling, softening, and material degradation • Inspect for tears, punctures, and zipper or seam damage • Check all taped areas to ensure they are still intact.
Gloves	Before use: • Pressurize rubber gloves to check for pinholes: Trap air in glove and roll to inflate glove for inspection. No air should escape. Leather gloves: • Inspect seams and glove surface for tears and splitting and verify no permeation has taken place.

6. PERSONNEL TRAINING

Training of Accelerated Retrieval Project construction and operations personnel is a key element of the hazard identification and mitigation process. In addition to required position-based training, all assigned personnel who access the construction or operations areas will be trained in requirements contained in this HASP and other safety and health documents. Personnel will receive training, as specified in the applicable section of the HAZWOPER standard (29 CFR 1910.120) and RWMC, DOE, federal, state, and INEEL companywide manuals as applicable.

All training will be developed, conducted, and maintained in accordance with *Training and Qualification* (Manual 12) and Accelerated Retrieval Project or applicable facility training procedures. The *Training and Qualification* manual describes the INEEL processes that ensure the INEEL work force is properly trained to work effectively and safely.

The Accelerated Retrieval Project nuclear facility manager (NFM) or project operations manager controls all support activities, including training, necessary to operate and maintain the facility.

6.1 Training

Line management ensures that Accelerated Retrieval Project personnel receive the training necessary to perform their job assignments safely and effectively. The training directorate oversees and coordinates training analysis, design, development, implementation, and evaluation, in close association with responsible management. The training directorate also ensures that employees who require qualification meet the minimum requirements and receive appropriate training. Other activities include maintaining training records.

Training settings and methods are selected to optimize learning experiences and training efficiency. They may include classroom training, web-based instruction, self-study, and on-the-job training as appropriate.

6.2 Personnel Selection

Personnel selection for the Accelerated Retrieval Project complies with the company staffing procedures. Employee position descriptions are used for personnel selection, and these position descriptions identify entry-level requirements for all INEEL personnel.

6.3 Qualification Processes

Qualification requires demonstration and documentation of experience, physical attributes, training, knowledge, and skills necessary to perform a specific job function. Supervisors are qualified by meeting entry-level requirements associated with the supervisory position and as identified in the project training plan . This ensures that supervisors possess the required knowledge and skills, when combined with their previous education, experience, and training, to perform responsibilities specific to their position. Positions that require qualification for the Accelerated Retrieval Project operations include excavator operator, waste handling/packaging operators, radiological control personnel, shift supervisors, and operations foremen.

6.4 Implementation of Training

The Accelerated Retrieval Project operations manager is responsible for ensuring that crafts and maintenance personnel assigned to work at the Accelerated Retrieval Project have the skills necessary for their particular craft. The Accelerated Retrieval Project facility manager is responsible for ensuring that crafts and maintenance personnel are qualified to perform assigned work at the facility in accordance with *Training and Qualification* (Manual 12).

Facility prejob briefings and facility-specific CERCLA, hazard communication, and HAZWOPER training courses satisfy requirements of "Hazard Communication" (29 CFR 1910.1200) and "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120), respectively. Radiological Control personnel assigned to support Accelerated Retrieval Project operations will participate in an ongoing training program in accordance with "Occupational Radiation Protection" (10 CFR 835) in addition to Accelerated Retrieval Project operations-specific training

The operations manager is responsible to ensure that personnel have an adequate level of facility knowledge, including a general overview of the facility, facility-specific hazards, safety, and applicable procedures. A thorough analysis of course work and other associated training required for Accelerated Retrieval Project operations personnel requiring certifications or qualifications will be performed, and a continuing training program for Accelerated Retrieval Project will be developed. The project training plan details positions of responsibility and positions requiring continuing training.

Table 6-1 addresses basic HAZWOPER and radiological training requirements for entry to Accelerated Retrieval Project operations areas. This is not a list of Accelerated Retrieval Project operational training requirements for assigned personnel but only a listing of the HAZWOPER access requirements . Individual training plans specifying qualification requirements for individual employees will be developed for Accelerated Retrieval Project operations personnel. Individual training plans are revised at least annually or as needed.

Personnel requiring Accelerated Retrieval Project operation- or position-specific qualifications will complete the necessary training before beginning their project activities. As appropriate, a qualified instructor or subject matter expert will conduct the training and document it in accordance with applicable procedures.

Table 6-1. Minimum required training for access to Accelerated Retrieval Project construction and operational areas.

Personnel and Operational Areas to be Accessed (unless specific positions are listed, minimum access requirements apply to all other operations personnel and visitors)	Shift Supervisor,[a] Subcontractor Technical Representative,[a] Operations Foremen, Operations Heavy-Equipment Operators, Accelerated Retrieval Operators, and Assigned Industrial Hygiene and Radiological Control Personnel	Project Construction Areas[b] (Subsurface Disposal Area construction areas)	Retrieval Enclosure (exclusion zone) and Airlock (contamination reduction zone) Facilities[b]	Accelerated Retrieval Project Subsurface Disposal Area Operations Controlled Areas and Operational Support Facilities (support zone)
Required Training				
40-hour HAZWOPER[c]—Operations	Yes	Yes[h]	Yes	
24-hour HAZWOPER[c]—Operations				Yes[h]
Project Health and Safety Plan Training[e]	Yes	Yes	Yes	Yes
Project-Site Orientation Briefing[f]		Yes		
Radiological Worker I or II[g]	Radiological Worker II	Escort or Radiological Worker II	Radiological Worker II	Radiological Worker II
Respiratory Protection	Yes[d]	Yes[d]	Yes[d]	Yes[d]

Note: Shaded fields indicate specific training is not required or applicable.

a. Will be trained to the HAZWOPER supervisor level.
b. Required training after construction removal of overburden and after start of operations waste retrieval activities. Contact the Radioactive Waste Management Complex shift supervisor for current status and additional training requirements.
c. Includes 8-hour HAZWOPER refresher training as applicable and supervised field experience as follows:
40-hour HAZWOPER = 24-hour supervised field experience and 24-hour HAZWOPER = 8-hour supervised field experience.
d. Respirator training is not required unless individual is required to wear a respirator. Respiratory protection training and fit test are required before donning a respirator.
e. Includes project-specific hazards communications (29 CFR 1910.120), site access and security, and decontamination and emergency response actions, as required by "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120[e]).
f. Orientation includes construction briefing of site hazards, designated work areas, emergency response actions, and personal protective equipment requirements. Personnel receiving project-site orientation briefing only are limited to the areas outside designated work areas and must be escorted by a project supervisor or designee who is fully trained on the requirements of the health and safety plan.
g. Training requirements and allowances for escort into radiologically controlled areas are provided in "Radiological Control Manual" (PRD-183). Source-user training is required for personnel directly handling radioactive sources in accordance with "Radioactive Source Accountability and Control" (MCP-137).
h. Visitors on official business may be escorted by a fully trained employee into the general Subsurface Disposal Area construction areas and operational support trailers without 24- or 40-hour HAZWOPER training but may not enter the Retrieval Enclosure or airlock structure after start of waste retrieval operations without 40-hour HAZWOPER training. Visitors must have prior authorization from the Radioactive Waste Management Complex shift supervisor with concurrence of the health and safety officer, and the facility operations must not present a risk of visitor exposure to potential contaminants of concern. Occasional site workers as defined in 29 CFR 1910.120 (e)(3)(ii) may be permitted on the project site with 24 hour HAZWOPER training following NFM review and concurrence.

HAZWOPER = hazardous waste operations and emergency response

6.5 Project Operations-Specific Training

As part of Accelerated Retrieval Project construction and operations access training, personnel will complete HASP training and will document it in accordance with the method of delivery.

A trained HAZWOPER supervisor (shift supervisor, STR, or other person who has been trained by the HAZWOPER supervisor) will monitor the performance of each newly 24- or 40-hour trained worker to meet the 1 (24 hour HAZWOPER) or 3 (40 hour HAZWOPER) days of supervised field experience. Following the supervised field experience period, the supervisor will complete "Hazardous Waste Operations (HAZWOPER) Supervised Field Experience Verification 29 CFR 1910.120" (Form 361.47), or equivalent, to document the supervised field experience.

Note 1: Supervised field experience is only required if personnel have not previously completed this training at another CERCLA (42 USC § 9601 et seq., 1980) site (documented) or if they are upgrading from 24- to 40-hour HAZWOPER training. A copy of the training record must be kept at the Accelerated Retrieval Project site as evidence of training or be available electronically in Training Records and Information Network (TRAIN System).

Note 2: Completed supervised field experience training forms ("Hazardous Waste Operations (HAZWOPER) Supervised Field Experience Verification 29 CFR 1910.120" [Form 361.47], or equivalent) should be submitted to the Accelerated Retrieval Project training coordinator for inclusion in the TRAIN System.

6.6 Prejob and Postjob Briefings and Safety Meetings

All Accelerated Retrieval Project construction and operational activities performed in accordance with companywide requirement documents will require a prejob briefing conducted by a supervisor. During this briefing, tasks associated with project will be outlined, hazards identified, hazard controls and mitigation reviewed, PPE requirements discussed, waste minimization opportunities communicated, and employees' questions answered. Following the completion of operational activities, a postjob briefing will be conducted with particular emphasis on capturing lessons learned and process improvement for future operations.

Other safety meetings on various subjects will be conducted periodically to reinforce specific safety topics. A shift supervisor, safety and health operations personnel, or worker may conduct a safety meeting. Attendance at the safety meetings will be documented on an applicable form and submitted to training personnel for entry into TRAIN.

7. SITE CONTROL AND SECURITY

The Accelerated Retrieval Project areas will be fenced or roped to prevent unauthorized entry into construction or operations areas. Entry into and exit out of the Accelerated Retrieval Project areas will be controlled through the appropriate use of barriers, signs, and other measures in accordance with "Accident Prevention Signs, Tags, Barriers, and Color Codes" (PRD-5117) for operations and "Safety Signs, Color Codes, and Barriers" (PRD-2022) for construction areas. Radiological controlled areas will be established by RadCon personnel in accordance with the "Posting Radiological Control Areas" (MCP-187).

Personnel not directly involved with Accelerated Retrieval Project construction or operations shall be excluded from entering the controlled areas. Visitors, such as inspectors, may be authorized to enter the established Accelerated Retrieval Project construction and operations area provided they are conducting official business and have met the minimum Accelerated Retrieval Project training requirements for the area to be accessed (as listed on Table 6-1 and as posted). Nonoperational personnel will not be allowed access to active construction or operational areas without processing through the RWMC shift supervisor. All training for access into the requested area will be verified. Nonoperational personnel will only be allowed into operational areas to perform the specific function for which access was granted and may be limited in these areas because of operational activities and associated hazards (at the discretion of the shift supervisor).

The Accelerated Retrieval Project construction area will be clearly posted as a construction area, and operations areas in the SDA will be posted and controlled as CERCLA-regulated areas. These areas are discussed in Sections 7.1, 7.2, 7.3, and 7.4.

7.1 Exclusion Zone

The Retrieval Enclosure will be posted and controlled as an exclusion zone after the start of waste retrieval operations (Figure 7-1). Personnel must have required PPE in accordance with the TPR, JSA, work order, or RWP as appropriate before entry into the exclusion zone. The shift supervisor must authorize personnel entry into the exclusion zone. Radiological controlled areas will be established by RadCon personnel in accordance with "Posting Radiological Control Areas" (MCP-187). The buddy system in accordance with section 4.5 is required anytime entry into the exclusion zone is made.

7.2 Contamination Reduction Zone and Contamination Reduction Corridor

Airlock Two will be posted as a contamination reduction zone (CRZ) after the start of waste retrieval operations, and Airlock One will be posted as a CRZ with the personnel access airlock and equipment service bays posted as Contamination Reduction Corridors (CRC) (Figure 7-1). Personnel must have required PPE in accordance with the TPR, JSA, work order, or RWP as appropriate before entry into the CRZ or CRC. The shift supervisor must authorize personnel entry into the CRZ and CRC. Radiological controlled areas will be established by RadCon personnel in accordance with "Posting Radiological Control Areas" (MCP-187). The buddy system is required anytime entry into the CRC is made in airlock one.

7.3 Support Zone

The SDA area immediately around the Retrieval Enclosure will be roped and posted as the support zone in accordance with HSO direction. Personnel must have required PPE in accordance with the TPR,

JSA, work order, or RWP as appropriate before entry into the support zone. Personnel entering the SDA and support zone must comply with all radiological postings and CERCLA signs.

7.4 Construction Area

The Accelerated Retrieval Project construction area will be clearly roped and posted with access requirement signs. During overburden removal, these access requirements will include restricted access to only personnel authorized by the STR. Radiological controlled areas will be established by RadCon personnel in accordance with "Posting Radiological Control Areas" (MCP-187). Personnel entering the SDA and construction area must comply with all radiological postings and CERCLA signs.

7.5 Site Security

The Accelerated Retrieval Project is secured and controlled with the existing RWMC fence and through appropriate posting to prevent entry into Accelerated Retrieval Project construction and operational areas. Additionally, INEEL security forces will provide general facility security in conjunction with RWMC operations.

Note: Signs are routinely lost because of high winds and will be replaced as soon as possible the next workday following discovery.

7.6 Wash Facilities and Sanitation

Project construction and operations will involve close contact with waste or potentially contaminated materials. Personnel will obey all radiological survey requirements to prevent inadvertent uptakes of radiological or chemical contaminants. Ingestion of hazardous substances is more likely when workers do not practice good personal hygiene habits during and following activities in the construction and operations areas of the project. It is important to wash hands, face, and other exposed skin areas thoroughly after completion of work and before smoking, eating, or chewing gum or tobacco.

Sanitation and shower facilities will be available for Accelerated Retrieval Project operations personnel within RWMC facility areas.

Note: No smoking, chewing, eating, or applying lip balm is allowed within CERCLA-regulated areas and radiologically controlled areas. A designated drinking area may be established in the support zone for heat stress prevention in accordance with IH and RadCon foreman review and restrictions.

7.7 Designated Eating Areas and Smoking Areas

The designated eating areas for construction and operations personnel will be established in the RWMC operations or administrative areas and includes the RWMC cafeteria (located in WMF-637) and designated eating areas.

Smoking will only be permitted in designated smoking areas outside the RWMC SDA. Personnel will comply with all INEEL smoking polices, including disposal of smoking materials in the proper receptacles. All "Idaho National Engineering and Environmental Laboratory Wildland Fire Management Guide" (GDE-7063) requirements related to smoking at the INEEL will be practiced.

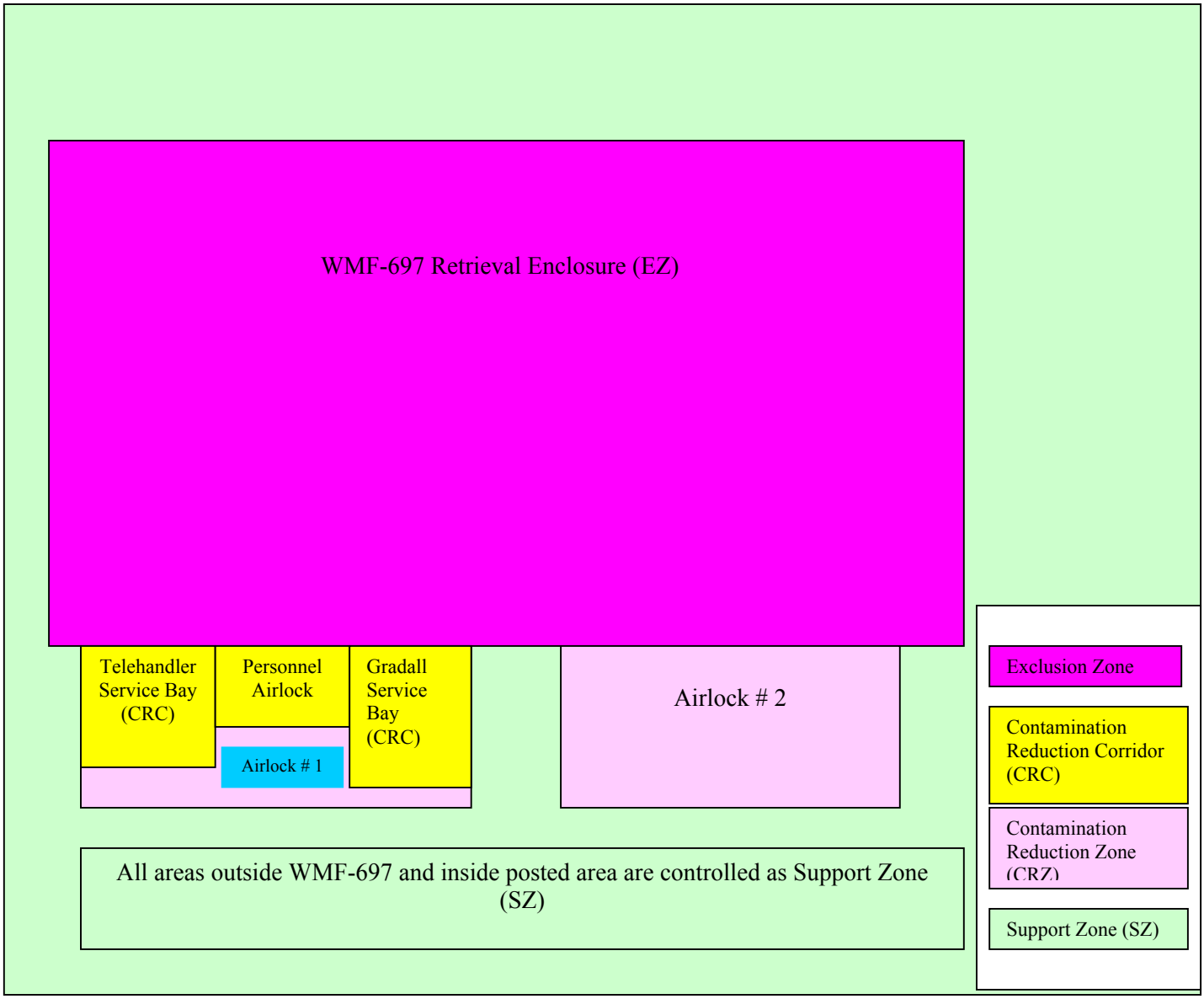


Figure 7-1. WMF-697 HAZWOPER Work Control Zones

8. OCCUPATIONAL MEDICAL SURVEILLANCE

The Accelerated Retrieval Project operations personnel shall participate in the INEEL OMP, defined in "Occupational Health Program" (PDD-61) to implement the requirements of "Worker Protection Management for DOE Federal and Contractor Employees" (DOE O 440.1A), "Contractor Occupational Medical Program Guide for Use with DOE Order 440.1" (DOE G 440.1-4), and "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120[f]). Medical surveillance examinations will be provided at the following times:

- Before assignment
- At least once every 12 months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is acceptable
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary
- Personnel who are or may be exposed to hazardous substances at or above the OSHA permissible exposure limit (PEL), or published exposure limits, without regard to respirator use for 30 or more days per year
- All employees who are injured, become ill, or develop signs or symptoms because of possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation
- All employees who wear a respirator for 30 days or more a year or as required by "Respiratory Protection" (29 CFR 1910.134).

Personnel who wear a respirator in performance of their job or who are required to take respirator training to perform their duties under this plan must participate in the medical evaluation program for respirator use at least annually as required by "Respiratory Protection" (MCP-2726).

If the OMP does not have sufficient information to complete a medical evaluation before respirator training, the employee's supervisor will be notified. The employee will not be permitted to fit test until the needed information is provided and any additional examination or testing is completed.

A single copy of the Accelerated Retrieval HASP, JSA requirements, required PPE, and other exposure-related information will be made available, upon request, to the INEEL OMP physician (and subcontractor physicians) conducting medical surveillance for employees participating in project operations. Exposure monitoring results and hazard information furnished to the OMP physician will be supplemented or updated annually if required (as stated in Section 12) as long as the employee is required to maintain a hazardous waste and material employee medical clearance. The OMP physician will then evaluate the physical ability of an employee to perform the work assigned.

The OMP physician shall evaluate the physical ability of Accelerated Retrieval Project operations personnel to perform the work assigned, as identified in this HASP; other project facility-related documentation; and individual training plans. A documented medical clearance (e.g., a physician's written opinion) will be provided to the employee and supervisor stating whether the employee has any

detected medical condition that would place him or her at increased risk of health impairment from project operations, emergency response operations, respirator use, and radiological work, as applicable. The OMP responsibilities, with regard to personnel assigned to project operations, include, but are not limited to, the following:

- Providing current comprehensive medical examinations (as determined by the examining physician) at an INEEL medical facility for full-time project operations personnel
- Obtaining records or reports from an employee's private physicians, as required by the OMP director
- Performing a medical evaluation on return-to-work cases following an absence in excess of 1 workweek (40 consecutive work hours) resulting from illness or injury
- Conducting a medical evaluation in the event that management questions the ability of an employee to work or if an employee questions his or her own ability to work.

Personnel are responsible for communicating any work or medical restrictions to their supervisor so modified work assignments can be made, if necessary. During the "Performing Pre-Job Briefings and Documenting Feedback" (MCP-3003) prejob briefing, the supervisor conducting the briefing should ask workers if they have any work restrictions. However, it is the responsibility of each employee to inform the supervisor of any work or medical restrictions.

Note: All managers, supervisors, and foremen have access to employees' current medical restrictions, certifications, and surveillances through the OMP database on the Safety and Health homepage or OMP reports link: http://webhome4/OMPReports/. This allows management to review medical restrictions, surveillances, and certifications before assigning work tasks to employees.

8.1 Project Operations Subcontractor Workers

If subcontractors participate in Accelerated Retrieval Project construction or operations or may be exposed to Accelerated Retrieval Project hazardous substances or health hazards at or above the established permissible exposure limit for these substances without regard to the use of respirators for 30 days or more a year, they shall participate in a subcontractor medical surveillance program that satisfies the requirements of "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120[f]). The physician's written opinion will serve as documentation that subcontractor personnel are fit for duty.

Medical data from the subcontractor employee's private physician, collected pursuant to hazardous material worker qualification, shall be made available to the INEEL OMP physicians, upon request. A subcontractor employee's past radiation exposure history may be requested and, if so, will be submitted to the INEEL radiation dosimetry and records section in accordance with "Issuing TLDs and Obtaining Personnel Dose History" (MCP-188) and "Personnel Exposure Questionnaire" (MCP-2381).

8.2 Injuries at the Accelerated Retrieval Project Site

It is policy that an INEEL OMP physician examines all Bechtel BWXT Idaho, LLC, injured personnel for the following reasons:

- An employee is injured on the job

- An employee is experiencing signs and symptoms consistent with exposure to a hazardous material
- An employee is believed to have been exposed to toxic substances or physical or radiological agents in excess of allowable limits during the course of a project at the INEEL.

Note: In the event of an illness or injury, the decision to provide first aid and transport to the nearest medical facility or whether to immediately request an ambulance and continue to stabilize and provide first aid should be based on the nature of the injury or illness and likelihood that transporting the individual may cause further injury or harm. Most likely, the person making this decision only will be trained to the medic first or CPR level and should contact the Central Facilities Area medical facility at 777 or 526-1515 for further guidance if there is any question as to the extent of injury or potential to cause further harm by movement of the injured individual.

In the event of a known or suspected injury or illness caused by exposure to a hazardous substance or physical or radiological agent, the employee will be transported to the nearest INEEL medical facility for evaluation and treatment. The shift supervisor is responsible for obtaining as much of the following information as is available to accompany the individual to the medical facility:

- Name, job title, work location, and supervisor's name and phone number
- Substance, physical or radiological agent exposed to (known or suspected), and MSDS, if available
- Nature of the incident and injury or exposure and associated signs or symptoms of exposure
- First aid or other measures taken
- Locations, dates, and results of any relevant personal or area exposure monitoring or sampling
- List of PPE worn during this work (e.g., type of respirator and cartridge used).

Further medical evaluation will be determined by the treating or examining physician in accordance with the signs and symptoms observed, hazard involved, exposure level, and specific medical surveillance requirements established by the OMP director in compliance with "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120).

Note: In the event of an illness or injury to a subcontractor employee, the employee will be transported to the nearest INEEL medical facility (CFA-1612) as appropriate based on injury severity to have the injury stabilized. The employee then will be transported to the subcontractor's treating physician or off-Site medical facility.

The RWMC shift supervisor will be contacted if any injury or illness occurs to personnel working for the Accelerated Retrieval Project. As soon as possible after an injured employee has been transported to the INEEL medical facility, the shift supervisor or designee will make additional notifications to management personnel.

Radiological Control personnel will evaluate all actual and suspected radiological exposures in excess of allowable limits and will establish follow-up actions. For internal uptakes (as calculated committed effective dose equivalent values), the "Established Levels of Radionuclide Intakes for Consideration of Medical Intervention" (EDF-INEL-003) will be used as the basis for this evaluation and follow-up actions. All wounds will be examined by an OMP physician to determine the nature and extent

of the injury. The RadCon supervisor in conjunction with an OMP physician will determine whether the wound can be bandaged adequately for entry into a radiological contamination area in accordance with Article 542 of the "Radiological Control Manual" (PRD-183).

8.3 Substance-Specific Medical Surveillance

Project operations will involve the excavation, handling, sampling, packaging, decontamination, and storage of SDA waste contaminated with radiological and chemical constituents. Several of the nonradiological waste constituents have OSHA substance-specific standards that govern the manner that personnel monitoring and medical surveillance are conducted. These substances have exposure action levels. The assigned IH will evaluate and document potential exposures to hazardous substances that trigger medical surveillance requirements. Based on the Industrial Hygiene exposure assessment, construction and operations personnel may be entered into the applicable medical surveillance programs.

All Accelerated Retrieval Project construction and operations will be evaluated to determine the hazards and potential exposures to operations personnel in accordance with "Activity Level Hazard Identification, Analysis, and Control" (PRD-25). The IH and RadCon personnel will conduct exposure assessments for each operation to determine the potential for exceeding exposure limits. The regulatory requirements for each OSHA-mandated substance-specific standard will be reviewed against exposure monitoring data (where available) and in the context of the exposure potential using professional judgment. Accelerated Retrieval Project operations involving use of chemicals listed in "13 Carcinogens" (29 CFR 1910.1003) and "Carcinogens" (MCP-2703) will require implementation of a carcinogen control program.

All exposures to ionizing radiation will be evaluated in accordance with the "Radiological Control Manual" (PRD-183) and, where deemed appropriate, be controlled through the use of an RWP in accordance with "Radiological Work Permit" (MCP-7).

If new Accelerated Retrieval Project waste forms or streams are identified or operational chemicals are introduced during the course of operations, then exposures will be evaluated and quantified to determine if a substance-specific standard applies. If regulatory, mandated, substance-specific standard action levels are triggered, then affected personnel will be enrolled in applicable substance-specific medical surveillance programs.

9. PERSONNEL ROLES AND RESPONSIBILITIES

The organizational structure for Accelerated Retrieval Project construction and operations reflects the resources and expertise required to operate the facility while minimizing risks to worker health and safety, the environment, and the general public. Job titles of the individuals in key roles at the Accelerated Retrieval Project are shown on the organizational chart in Figure 9-1. The operations organization includes project operations management and supervision; operators and technicians; environment, safety, health, and quality assurance representatives; and support personnel. The NFM and the Accelerated Retrieval Project manager will interface to determine the most appropriate use of these resources.

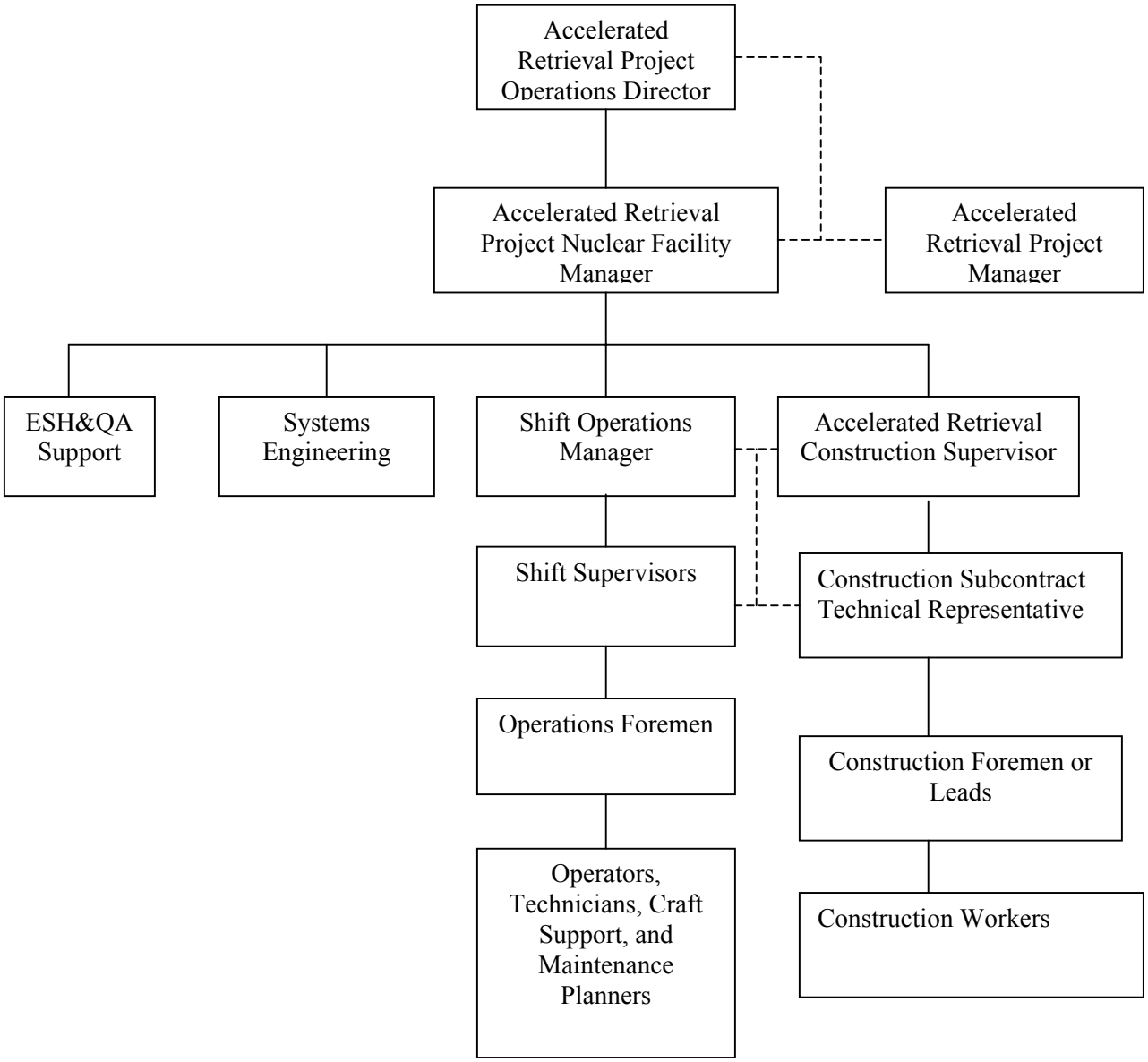


Figure 9-1. Organizational interfaces for the Accelerated Retrieval Project.

9.1 Project Operations Personnel

9.1.1 Project Operations Management

9.1.1.1 Accelerated Retrieval Project Operations Director. Because construction; operations; and deactivation, decontamination, and decommissioning activities for the Accelerated Retrieval Project will occur within the RWMC operations boundary, the Accelerated Retrieval Project operations director will serve as the operations director for all Accelerated Retrieval Project field tasks.

The operations director will provide infrastructure programs to support facility safety and work processes for personnel assigned to the Accelerated Retrieval Project area. These programs include supplying support services (e.g., maintenance craft skills, RadCon personnel, and engineering support), equipment (e.g., forklifts and water trucks), and document control and records management functions. The RWMC operations director also establishes and staffs an Emergency Response Organization (ERO), which includes developing site-specific emergency plans and maintaining a command post and support equipment.

9.1.1.2 Accelerated Retrieval Project Nuclear Facility Manager. The Accelerated Retrieval Project NFM is responsible for all Accelerated Retrieval Project area operational activities and supports the project for startup, operations, and maintenance activities related to Accelerated Retrieval Project scope, schedule, and budget performance. The NFM will ensure that documents identified within the Accelerated Retrieval Project authorization basis (i.e., safety analysis report, technical safety requirement, and permits) remain current and adequately address the scope and hazards encountered for activities within the scope of the Accelerated Retrieval Project. The NFM is responsible for the safe operation of Accelerated Retrieval Project equipment and facilities and for ensuring that safety systems protect human health and the environment.

9.1.1.3 Shift Operations Manager. The shift operations manager is responsible for the day-to-day operational activities of the Accelerated Retrieval Project. Specific duties and responsibilities include directing performance of operational activities in accordance with the approved schedule, communicating expectations to the crews, assessing their readiness to perform work in a manner consistent with all applicable safety and health requirements and company procedures, and managing the operational shift crews.

9.1.2 Shift Operations

9.1.2.1 Shift Supervisor. The shift supervisor is the individual responsible on-shift during Accelerated Retrieval Project construction and operations and has authority to act for management during normal and abnormal operations. Specific duties and responsibilities include ensuring the efficient execution of work and ensures conduct of operations is performed safely and protective of human health and the environment.

9.1.2.2 Operations Foremen. Operations foremen are responsible for on-shift waste handling operations and maintenance activities and for reporting to the RWMC shift supervisor. The foreman ensures the safe and efficient execution of work for waste retrieval, segregation, handling, and storage and ensuring conduct of operations is performed in such a way as to protect human health and the environment.

9.1.2.3 Operators (Waste Handling, Processing and Packaging). Operators are assigned to each shift to perform waste handling, processing, and packaging. This includes waste sorting inside the drum packaging stations, waste packaging into drums, waste drum movements inside the WMF-697

Airlock Two, fissile material monitoring of suspect fissile materials, collecting waste samples, and other tasks as directed by the Operations Foreman. Operators will be fully qualified to perform their prescribed duties.

9.1.2.4 Visual Examination Processors. The visual exam processors will assist the heavy equipment operators determine targeted and nontargeted waste forms during waste retrieval operations, and assist operators determine waste types during waste processing in the drum packaging stations.

9.1.2.5 Data Recorder. The data recorder will assist with the identification and characterization of waste in the drum packaging system , record data, enter data into the drum tracking system and, when required, act as a verifier of waste disposition locations.

9.1.2.6 Heavy-Equipment Operators. Specific duties and responsibilities include operating the excavator and telehandler forklift inside the Retrieval Enclosure. Heavy equipment operators will also operate equipment to transport drums for drum assay and storage.

9.1.2.7 System Engineers . System engineers are responsible to the operations manager and the NFM and will receive day-to-day direction through the lead system engineer. Specific duties and responsibilities include the following:

- Verifying that all proposed design changes meet all applicable requirements
- Establishing and maintaining technical baselines
- Managing the engineering change control process
- Implementing configuration management for each structure, system, and component for which the system engineer is or will be responsible.

9.1.2.8 Radiological Control Technicians. Radiological control technicians report directly to the facility RCT foreman and are responsible for ensuring compliance with the INEEL RadCon program within the Accelerated Retrieval Project, including acting as a RadCon information resource for project personnel. Also, during emergencies, RCTs are responsible for stopping work or ordering an area evacuated when an imminent radiation hazard exists and such actions are necessary to ensure worker safety.

9.1.2.9 Radiological Control Technician Foreman. Specific duties and responsibilities of the RCT foreman include directing and supervising day-to-day activities for RCTs, reviewing RWPs, and ensuring that requirements of applicable DOE orders, company programs, and the "Radiological Control Manual" (PRD-183) are properly incorporated into project-specific procedures, practices, and controls.

9.1.2.10 Mechanics and Instrument Technicians. Maintenance personnel are responsible for maintenance and repair of project operations mechanical and electrical equipment. Personnel in this category include all maintenance crafts, life safety systems technicians, and their line management. Technicians are responsible for specific maintenance and monitoring activities that include equipment maintenance, troubleshooting, repair, testing, instrument calibration, inspections, and data surveys.

9.1.3 Environment, Safety, Health, and Quality Assurance

9.1.3.1 Health and Safety Officer. The HSO will be onsite during all construction and operations field tasks to assess and resolve safety and health issues. The HSO must have the knowledge necessary to

implement the HASP and verify compliance with the applicable health and safety requirements. The HSO may be assigned other duties, as long as the duties do not interfere with the primary responsibilities of HSO. This position will be filled by the responsible safety or IH professional and may be executed by the shift supervisor or subcontract technical representative when the safety/IH professional is not at RWMC. This transfer of HSO duties must be understood by both parties prior to the safety/IH leaving RWMC.

9.1.3.2 Radiological Engineer. The radiological engineer provides radiological engineering support within the project. Specific duties and responsibilities include acting as point of contact for all radiation protection issues related to the project, ensuring that radiological hazards are identified and appropriate controls are implemented to maintain worker exposure to those hazards ALARA, and identifying conditions that may impede implementation of company standards for safety, quality, and operations and maintenance. The radiological engineer is also responsible for initiating actions to correct conditions, including stopping work if necessary, that adversely impact safety, quality, or operations and maintenance.

9.1.3.3 Environmental Engineer. Responsibilities of the environmental engineer include providing overall technical expertise with respect to regulatory issues, natural and cultural resources, and risk assessment for the Accelerated Retrieval Project. The environmental engineer identifies environmental and regulatory issues that affect operations and develops solutions in coordination with the Accelerated Retrieval Project engineer and other project task leads. The environmental engineer also works with the project task leads and management to develop appropriate mitigation measures that minimize potential noncompliance with environmental requirements when environmental issues are identified.

9.1.3.4 Safety Engineer. The assigned construction and project safety engineer(s) reviews work packages, observes construction and operational activities, assesses compliance with the safety and health manuals, signs SWPs, advises the shift supervisor on required safety equipment, answers questions on safety issues and concerns, and recommends solutions to safety issues and concerns that arise during operations. The safety professional may conduct periodic inspections in accordance with "Safety and Health Inspections" (MCP-3449) and may have other duties at the task site as specified in other sections of this HASP or in INEEL program requirements documents or MCPs. Additionally, the safety professional will support Accelerated Retrieval Project facility and project management by investigating accidents and injuries and preparing written reports to project and facility management related to hazard identification and appropriate mitigation efforts.

9.1.3.5 Industrial Hygienist. The assigned IH(s) is the primary source for information about nonradiological hazardous and toxic agents during operations. The IH assesses the potential for worker exposures to hazardous agents in accordance with the INEEL safety and health manual MCPs and accepted industry Industrial Hygiene practices and protocol. By participating in work control development and approval process, the IH assesses and recommends appropriate hazard controls for the protection of operations personnel, operates and maintains airborne sampling and monitoring equipment, reviews for effectiveness, and recommends and assesses the use of PPE required in this HASP (recommending changes as appropriate to facility management).

9.1.3.6 Quality Assurance Engineer. Duties and responsibilities of the quality assurance engineer include implementing internal quality monitoring, assessment, and surveillance by establishing and maintaining an internal assessment and monitoring schedule, reviewing design and performance specifications and other design documents to determine if quality requirements are properly included, and ensuring quality assurance compliance is achieved in accordance with applicable requirements established by the company, DOE, state, and federal regulations.

9.1.4 Operations Support

9.1.4.1 Production Coordinators. Specific duties and responsibilities of the production coordinators include interfacing between operations and all other project teams (e.g., project management, design, safety, and health, environmental, criticality protection, radiological controls, records management, and document control) to help ensure that operations is informed of requirements that impact operational activities; the underlying driver for all requirements impacting operational activities is known and understood; and Accelerated Retrieval Project deliverables that are not created by operations, but impact operations documents and responsibilities, are coordinated and scheduled for delivery in time to support operational deadlines.

9.1.4.2 Safety Analyst. The safety analyst performs nuclear safety analyses and prepares and maintains the nuclear safety analysis documents required by "Safety Basis Requirements" (10 CFR 830, Subpart B). Specific duties and responsibilities include acting as the point of contact for safety analysis issues related to the Accelerated Retrieval Project, scheduling and tracking safety analysis work, preparing and maintaining documented safety analyses and technical safety analysis requirements, and preparing unreviewed safety question screens and evaluations.

9.1.4.3 Waste Generator Services Facility Representative and Technical Specialist. Duties and responsibilities of the Waste Generator Services facility representative and technical specialist include the following:

- Collaborating with project personnel to complete initial evaluation of waste types generated as part of process operations
- Assigning a probable waste type
- Maintaining the waste management records in the INEEL Integrated Waste Tracking System database
- Meeting with the waste generator to obtain and document the following information:
    - Identification of the waste generation process, schedule, and potential pollution prevention opportunities
    - Identification of starting materials for the waste generation process
    - Definition of the expected waste material components and characteristics, and all process knowledge data.

The Waste Generator Services facility representative and technical specialist assumes cradle-to-grave responsibilities for a given waste stream and ensures that all activities in this process are completed.

9.1.4.4 Radioactive Waste Management Complex Classification Officer and Security Personnel. The RWMC security personnel provide facility security, review procedures and plans before waste retrieval or relocation, and address security concerns expressed by Accelerated Retrieval Project personnel. In addition, these personnel conduct damage assessments in the event of a security incident, coordinate with U.S. Department of Energy Idaho Operations Office Security and the Classification Officer, and identify any added security measures required.

9.1.4.5 Training Specialist. Duties and responsibilities include supporting line management through training analysis, design, development, implementation, and evaluation to ensure all personnel on the Accelerated Retrieval Project are properly trained and qualified to perform their assigned tasks.

9.1.4.6 Administrative Support. Administrative support and office personnel are responsible for support functions that do not involve actual facility operations. Activities performed, such as word processing, filing, stocking office supplies, and answering the phone, are performed exclusively in an office environment.

9.1.5 Visitors

All visitors with official business in the Accelerated Retrieval Project construction and operational areas (including INEEL personnel, representatives of DOE, and state or federal regulatory agencies) may not proceed into the controlled area without having the appropriate training (see Table 6-1) as described below:

- Receiving training
- Signing applicable entry logs and work control documents (for the area to be accessed)
- Wearing the appropriate PPE.

A fully trained Accelerated Retrieval Project representative (e.g., shift supervisor or operator) will escort visitors entering the project operational areas.

Note 1: Visitors may not be allowed into the Accelerated Retrieval Project during certain activities to minimize safety, health, and radiological hazards to the visitors. The determination as to any visitor's demonstrated need for access into the construction or operational area will be made by the shift supervisor.

Note 2: Visitors with no official business at project operations areas will not be permitted.

10. EMERGENCY RESPONSE

This emergency response section defines the roles and responsibilities of Accelerated Retrieval Project operations personnel during an emergency. Such an emergency could be within the Accelerated Retrieval Project operations area, at the RWMC, or a Sitewide emergency. This section provides emergency plan contingencies at a project level and is a HAZWOPER-mandated supplemental plan to the "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114). The "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114) describes the overall process developed to respond to and mitigate consequences of emergencies that might arise at the INEEL. This section defines the responsibilities of Accelerated Retrieval operations personnel and their interface with the INEEL ERO by providing guidance for responding to abnormal events during project operational activities.

The "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114) may be activated in response to events occurring at the RWMC, at the Accelerated Retrieval Project complex, or at the discretion of the emergency coordinator. Once the INEEL plan is activated, Accelerated Retrieval Project operations personnel will follow the direction and guidance communicated by the Emergency Coordinator.

Note: The OSHA HAZWOPER definition of an emergency is not defined the same as in "Comprehensive Emergency Management System" (DOE O 151.1B) and "Occurrence Reporting and Processing of Operations Information" (DOE O 232.1A). For this reason, the term event will be used in this section when referring to project operational HAZWOPER emergencies.

10.1 Preemergency Planning

The "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114) provides the basis for preplanning all INEEL emergency events. This base plan is supplemented with INEEL facility-specific addendums. This preplanning makes it possible for the project to anticipate and appropriately respond to abnormal events that can affect operational activities. Preplanning also ensures that this project operations emergency response plan (Section 10) is integrated with the INEEL and RWMC emergency response programs. Specific procedures for addressing emergency events and actions to be taken are further described in the facility-specific emergency implementing procedures. Finally, this HASP addresses operational-specific hazards, potential emergency events, and the protective actions to take following such events. Emergency response program planning elements that must be completed before the initiation of project operations include the following:

- Establishing emergency warning signals and evacuation routes
- Establishing effective site communications
- Establishing requirements for emergency equipment and supplies
- Implementing personnel accountability procedures
- Identifying an adequate number of CPR and medic first-aid-trained personnel
- Establishing the preferred means for notifying the INEEL ERO of abnormal events.

Note: All Accelerated Retrieval Project operational emergencies will be reported through the RWMC shift supervisor to the ERO for classification in accordance with Section 4 of "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114). If the RWMC ERO is activated, site emergency response will follow "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114) and "Emergency Management Addendum 3—RWMC" (PLN-114-3).

10.2 Emergency Preparation and Recognition

The HASP sections for hazards identification and mitigation (Section 2) and accident prevention (Section 4) provided the strategy that will be followed at Accelerated Retrieval Project areas to prevent accidents. Similarly, emergency preparation and recognition also will require operations personnel to be constantly alert for potentially hazardous situations and signs and symptoms of chemical exposure or releases. All Accelerated Retrieval Project personnel should be familiar with the techniques for hazard recognition and the associated response, including proper operational notifications. Emergency phone numbers and evacuation route maps will be located throughout project operational areas.

Preparation and training on emergencies will include proper project access and egress procedures in response to project operational events and INEEL emergencies as part of the HASP training and project operations area access training where applicable. Visitors also will receive a briefing on emergency procedures during the hazard and general operations orientation briefing (see Table 6-1) and potentially complete HASP training depending on the project operations area to be accessed. Visitor emergency actions briefing will include alarm identification, location and use of communication equipment, location of site emergency equipment, and evacuation.

On-scene response to and mitigation of operational emergencies could require the expertise of INEEL fire department and medical personnel. Emergencies that could occur include the following:

- Accidents resulting in injury
- Fires
- Spills of hazardous or radiological materials
- Tornadoes, earthquakes, and other adverse natural phenomena
- Vehicle or transportation emergencies
- Safeguard and security emergencies
- Emergencies at nearby facilities that could prompt evacuation or take-cover actions at the task site.

10.3 Emergency Facilities and Equipment

Emergency response equipment, including the items described in Table 10-1, will be maintained within the Accelerated Retrieval Project area. The "Emergency Management Addendum 3—RWMC" (PLN-114-3) lists emergency equipment available at RWMC. This includes the emergency command post located in WMF-637 and equipment located in WMF-601 at RWMC. Additional heavy construction and other equipment listed in "Emergency Management Addendum 3—RWMC" (PLN-114-3) is available for use during emergencies.

The INEEL fire department maintains an emergency hazardous material response van that can be used to respond to an event or emergency within the project operations areas. Fire department personnel also are trained to provide medical services and immediate response to hazardous material spills. Additionally, the CFA-1612 medical facility is manned by medical personnel to evaluate and stabilize injured personnel or those experiencing signs and symptoms of exposure. At least two individuals with current medic and first-aid training will be present within the Accelerated Retrieval Project construction and operations area during field activities.

Table 10-1. Emergency response equipment to be maintained at the Accelerated Retrieval Project site during construction and operations.

Equipment Name and Quantity Required	Location at Operable Unit 7-10 Project	Responsible Person	Frequency of Inspection
Fire extinguishers[a]	Located throughout the construction and operations area, administration buildings, Retrieval Enclosure, Airlocks, Storage Enclosure, and on each piece of industrial and heavy equipment.	STR or shift supervisor	Monthly
First-aid supplies	Designated administrative trailer.	STR or shift supervisor	Monthly
Eyewash station	At designated operational area in airlock (after construction). In construction area where there is a significant eye hazard (as determined by the industrial hygienist and safety professional).	STR or shift supervisor	Monthly or the frequency determined by the manufacturer
Eyewash bottle[b]	At strategic locations throughout the construction area as determined by the industrial hygienist and safety professional.	STR	Monthly or replace after use
Hazardous materials spill kit	Contamination reduction zone in Airlock Enclosure #1 or construction area as determined by health and safety officer.	STR or shift supervisor	Monthly
Communication equipment available	In all construction and operational areas or in possession of STR or operations foreman.	STR or operations foreman	Availability and daily functional check

a. 10A/ 60BC extinguishers or as specified by the Radioactive Waste Management Complex fire protection engineer.
b. An eyewash bottle will be used to provide an immediate eye flush if required. Portable eyewash stations that meet the "Emergency Eyewash and Shower Equipment" (ANSI Z358.1-1998) requirement are available at the Radioactive Waste Management Complex and other locations as determined by the industrial hygienist and safety professional. Employees are instructed to use the bottles and immediately proceed to the permanent eyewash station. Eyewash stations will be located within 30.5 m (100 ft) or 10 seconds from significant eye hazard operations as determined by the industrial hygienist and safety professional.

STR = subcontractor technical representative

10.4 Emergency Communications

In the event of an emergency, capability to perform the following actions is required:

- Summon INEEL emergency response resources
- Immediately notify operations personnel
- Inform others of the emergency.

Communications equipment within the Accelerated Retrieval Project operations areas will include a combination of radios, telephones (i.e., mobile, cellular, or hardline), and pagers. The shift supervisor will be notified of any project emergency event, and the shift supervisor will then make the required INEEL ERO notifications.

10.4.1 Notifications

During emergency situations, the operations foreman will be notified of any operational emergency event. The operations foreman will then notify the RWMC shift supervisor who will make the required ERO and Warning Communications Center (WCC) notifications. The following information should be communicated, as available, to the RWMC shift supervisor:

- The caller's name, title (e.g., operations foreman or STR), telephone number, and pager number
- Exact location of the emergency
- Nature of the emergency including time of occurrence, current site conditions, and special hazards in the area
- Injuries, if any, including number of injured, types of injuries, and conditions of injured personnel
- Emergency response resources required (e.g., fire, hazardous material, and ambulance)
- Additional information as requested.

Note: If the shift supervisor cannot be contacted, then the WCC will be notified of the emergency event, and the information listed above will be communicated. The WCC also must be told that notification to the shift supervisor and emergency coordinator has not been made.

10.5 Personnel Roles, Lines of Authority, and Training

10.5.1 Idaho National Engineering and Environmental Laboratory Emergency Response Organization

The INEEL ERO structures are based on the incident command system and are described in "Emergency Management Addendum 3—RWMC" (PLN-114-3) and facility-specific addendums to that plan.

10.5.2 Role of Operations Personnel in Emergencies

Depending on the event, a graded response and subsequent notifications will take place. The shift supervisor and operations personnel responsibilities are described in Sections 10.5.2.1 and 10.5.2.2. Operations personnel will respond to emergencies only within the limits of their training and designated by their position. All personnel are trained to the Accelerated Retrieval Project and RWMC-specific emergency actions as part of the access training or will be escorted by someone who has been trained.

10.5.2.1 Accelerated Retrieval Project Operations Foreman . The operations foreman is responsible for initiating all requests for emergency services (e.g., fire and medical) and for notifying the RWMC shift supervisor of abnormal or potential abnormal events occurring within the project operations area. In addition, the operations foreman or trained alternate will serve as the area warden. The area

warden is responsible for conducting personnel accountability for all operations areas. This will be accomplished by completing sweeps of all Accelerated Retrieval Project buildings and areas to ensure personnel are aware of the emergency event. A visual sweep conducted from a safe location will be performed for the areas where physical access is limited (e.g. EZ, CRC) Following notification of the emergency event, operations personnel will be directed to the designated assembly point where the attendance log (or equivalent) will be used to determine what personnel are onsite (role call). The Accelerated Retrieval Project operations foreman then will report accountability status to the RWMC shift supervisor, who will in turn communicate this information to the RWMC emergency coordinator.

Additionally, the operations foreman will control the scene of any emergency event (from a safe distance) until a member of the Incident Command System authority arrives at the scene to take control as the on-scene commander. When communicating emergency information to the on-scene commander, the operations foreman will provide all requested information about the nature of the event, potential hazards, and other information requested by the on-scene commander.

10.5.2.2 Personnel Accountability and Area Warden. The Accelerated Retrieval Project personnel are required to TAKE COVER within the project area or may be required to evacuate the project operations area or RWMC in response to an EVACUATION. In each case, the shift supervisor, STR, or trained alternate shall account for the people present within the operations area. The shift supervisor, STR, or trained alternate will serve as the area warden for project operations and complete the personnel accountability (following positive sweeps of Accelerated Retrieval Project buildings and areas). The results of this accountability will then be reported to the RWMC shift supervisor or emergency coordinator (if the emergency coordinator has been informed).

10.5.2.3 Spills. If the material spilled is known and is small enough to be safely contained, project operations personnel will handle spill control within their level of training (as described in Sections 10.5.2.3.1 and 10.5.2.3.2) using spill supplies in the project operational area. The spill will be immediately reported the to the RWMC shift supervisor. Reporting requirements will be determined by the RWMC emergency coordinator in accordance with "Event Investigation and Occurrence Reporting" (MCP-190). If any release of a hazardous material occurs, task site personnel will comply with the following immediate spill response actions.

10.5.2.3.1 Untrained Initial Responder—The requirements for the untrained initial responder (or if the material characteristics are unknown) are listed below:

- Place equipment in a safe configuration (as applicable)
- **Evacuate** and **isolate** the immediate area
- Notify and then **seek help** from and **warn** others in the area
- Notify the shift supervisor.

10.5.2.3.2 Trained Responder—The requirements for the trained responder where material characteristics are known and no additional PPE is required are listed below:

- Place all equipment in a secure configuration (as applicable)
- **Seek help** from and **warn** others in the area

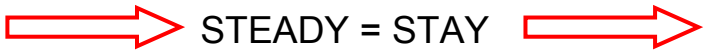
- **Stop** the spill if it can be done without risk (e.g., returning the container to the upright position, closing valve, and shutting off power)
- **Provide** pertinent information to the shift supervisor
- **Secure** any release paths if safe to do so.

10.6 Emergency Alerting, Responses, and Sheltering

10.6.1 Alarms

Alarms and signals are used at the Accelerated Retrieval Project and the INEEL to notify personnel of abnormal conditions requiring a specific response. These include radiation-monitoring alarms denoted by fast-ringing bells and fire alarms that may vary from building to building within the RWMC and Accelerated Retrieval Project areas. Responses to these alarms are addressed in the general employee and site-access training for environment, safety, and health employees. In addition to these alarms, emergency sirens located throughout the RWMC serve as the primary means for signaling emergency TAKE COVER or EVACUATION protective actions.

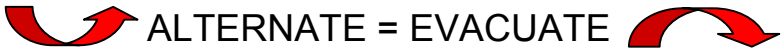
10.6.1.1 Take Cover—Continuous Siren. Radiation or hazardous material releases, adverse weather conditions, or other event or emergency conditions may require that all personnel take cover indoors in the nearest building. A TAKE COVER protective action may be initiated as part of a broader response to an emergency situation and may precede an evacuation order. The order to TAKE COVER is usually announced by activating the emergency siren. The signal to take cover is a CONTINUOUS SIREN. The order to TAKE COVER is usually announced by activating the RWMC emergency siren.



TAKE COVER also can be given by word of mouth, radio, or voice paging system. When ordered to TAKE COVER, project personnel will place project operations equipment in a safe configuration (as applicable) and then seek shelter in project operations or administrative buildings (if outdoors). Eating, drinking, and smoking are not permitted during take-cover conditions.

Radiological Control personnel will assist and direct all workers exiting from radiological contamination areas during a TAKE COVER alarm.

10.6.1.2 Total Area Evacuation—Alternating Siren. A total area evacuation is the complete withdrawal of personnel from the entire project operations and RWMC area. The evacuation signal is an ALTERNATING SIREN.



When ordered to EVACUATE, operations personnel will place project operations equipment in a safe configuration (as applicable) and then proceed along the specified evacuation route to the designated assembly area or as directed by the emergency coordinator. For total area evacuations, the RWMC command post is activated and all personnel will gather at the primary RWMC evacuation assembly area or the location designated by the emergency coordinator. The shift supervisor or trained alternate will then complete the personnel accountability and report the result of the accountability process to the RWMC emergency coordinator. Radiological Control personnel will assist and direct all workers exiting

from radionuclide-contamination areas during an EVACUATION alarm. Eating, drinking, and smoking are not permitted during emergency evacuations.

10.6.1.3 Local Area (Figure 7-1) Evacuation. A local area evacuation is the complete withdrawal of personnel from a portion of or all Accelerated Retrieval Project areas, but it does not necessarily require the complete evacuation of the entire RWMC. The order to evacuate project areas also can be given by word of mouth, radio, or voice paging system. When ordered to evacuate the project area, personnel shall place the project equipment in a safe condition (as applicable) and then proceed along the specified evacuation route to the assembly area designated for local area evacuations, or as directed by the shift supervisor or STR. (Emergency evacuation routes for each project building will be developed and posted following construction.) The shift supervisor or STR will then conduct personnel accountability and report the emergency event to the RWMC shift supervisor as described above. Eating, drinking, and smoking are not permitted during emergency evacuations. Radiological Control personnel will assist and direct all workers exiting from radiological contamination areas during a local area evacuation alarm.

10.7 Evacuation Assembly Areas and Central Facilities Area Medical Facility

The RWMC maintains primary and secondary evacuation routes and assembly areas. These routes may be used in response to a total facility evacuation as directed by the RWMC emergency coordinator. Copies of the following figures will be available in the project area. Figure 10-1 contains a map showing the location of the CFA-1612 medical facility, and Figure 10-2 shows the RWMC evacuation and assembly areas.

In the event that the project operational area is evacuated, personnel shall assemble in the designated assembly area, or as directed by the shift supervisor (local area evacuation) or RWMC emergency coordinator. If a total area evacuation of the RWMC is ordered, then project personnel shall relocate to the RWMC primary evacuation assembly area (see Figure 10-2) or as directed by the emergency coordinator.

10.8 Medical Emergencies and Decontamination

Medical emergencies and responses to injuries or suspected exposures will be handled as stated in Section 8.2. Decontamination of personnel and equipment is described in Section 11.2.

10.9 Reentry, Recovery, and Site Control

All reentry and recovery activities will follow general Site security and control requirements identified in Section 7 unless conducted as part of an emergency response action. All entries into Accelerated Retrieval Project areas performed in support of emergency actions will be controlled by the on-scene commander.

10.9.1 Reentry

During an emergency response, it is sometimes necessary to reenter the scene of the event. Reasons for performing a reentry may include:

- Performing personnel search and rescues
- Responding to medical first-aid needs

- Performing safe shutdown actions of operational equipment or processes
- Performing mitigating actions
- Evaluating and preparing damage reports
- Performing radiation or hazardous material surveys.

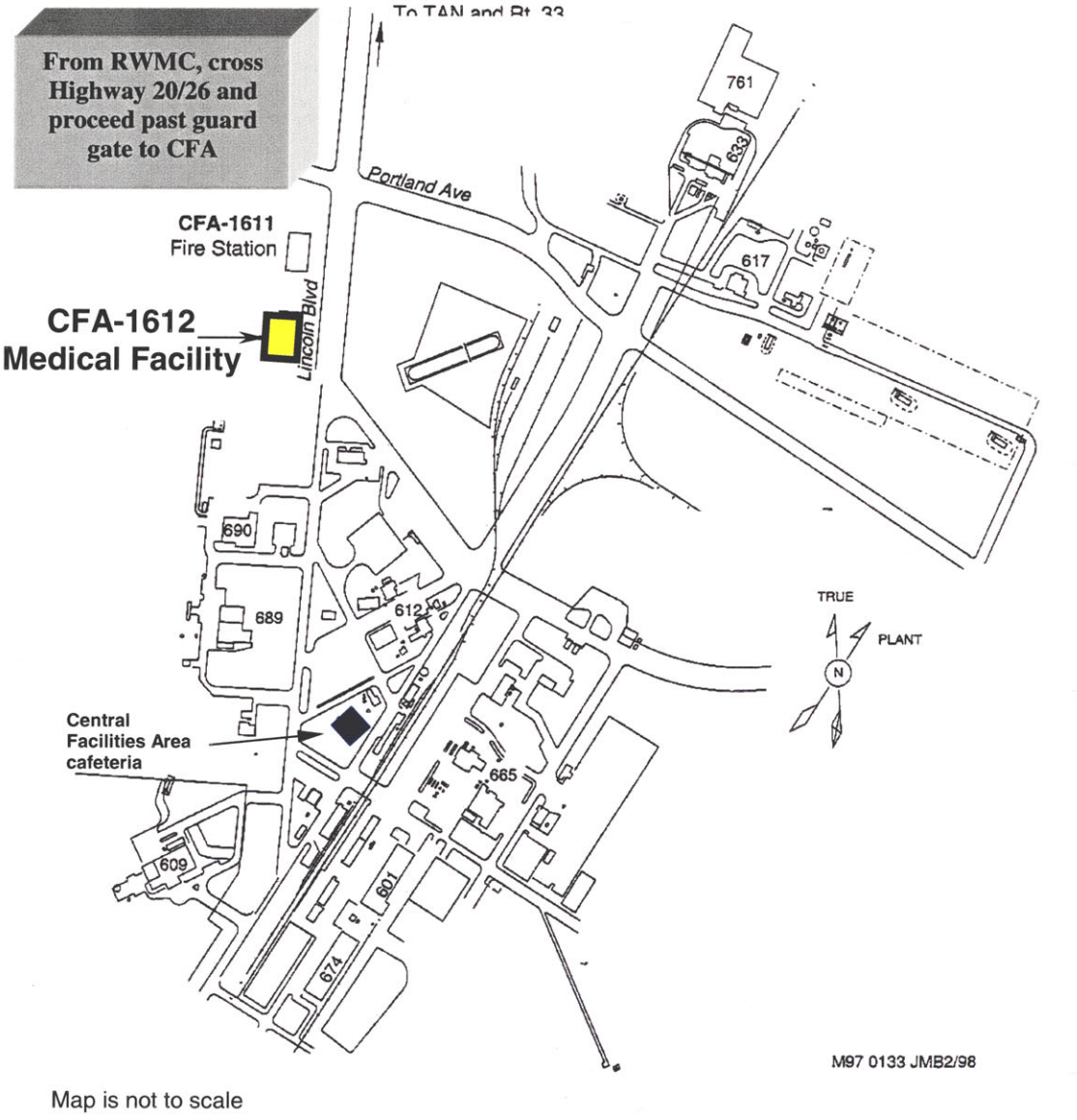


Figure 10-1. Map showing the route to the nearest medical facility (CFA-1612).

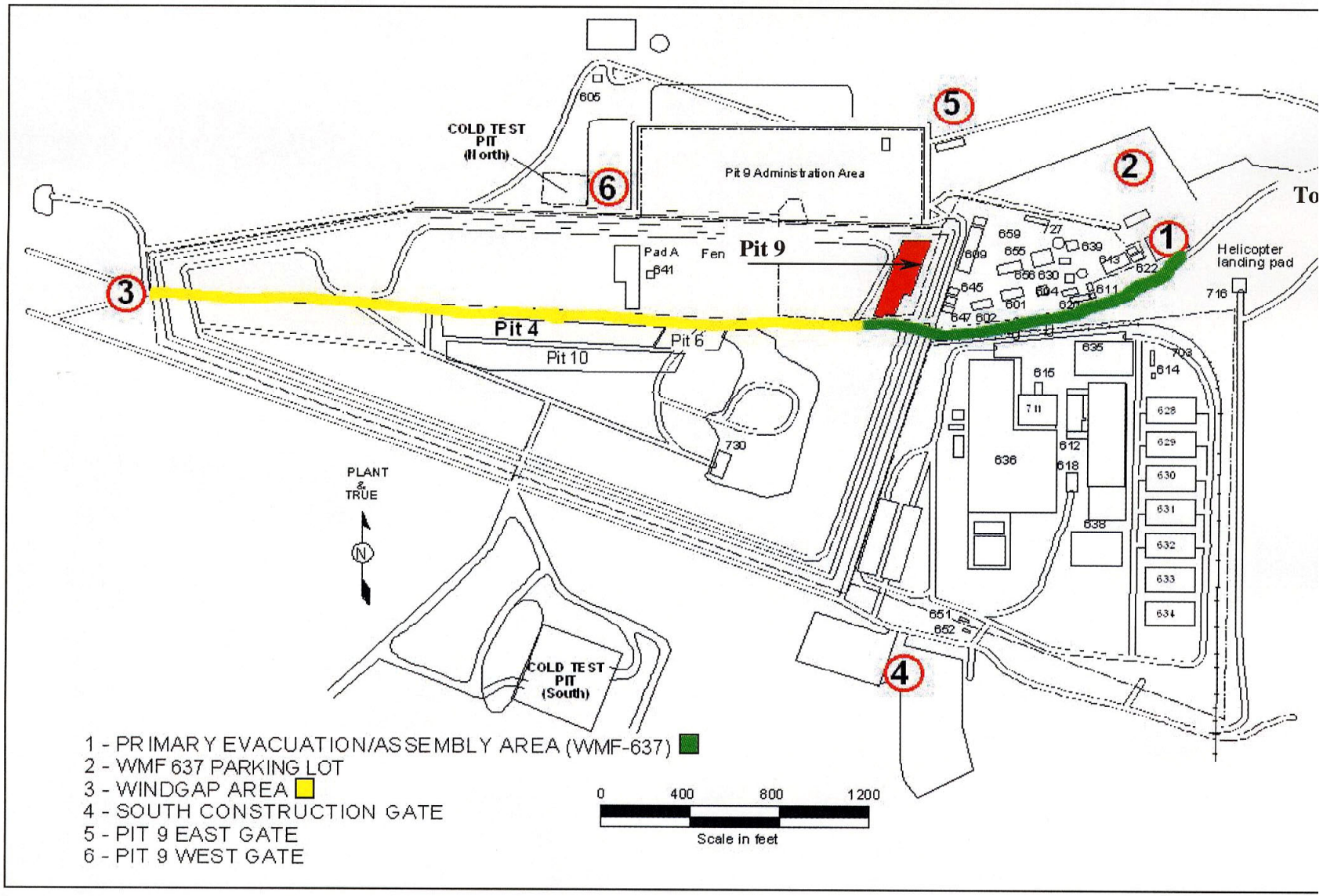


Figure 10-2. Evacuation and assembly areas at the Radioactive Waste Management Complex.

Reentries will be carefully planned to ensure that personnel are protected from harm and to prevent initiating another emergency event. Reentry planning is undertaken on a graded approach and will be based on the nature of the initiating event, hazards to personnel and structures, and purpose for the reentry. All reentries will be approved by the emergency coordinator in accordance with Emergency Plan Implementing Procedure-77, "Reentry."

10.9.2 Recovery

After the initial corrective actions have been taken and effective control established, response efforts will shift toward recovery. Recovery is the process of (1) assessing postevent and postemergency conditions, (2) developing a plan for returning to preevent and preemergency operating conditions, when possible, and (3) following the plan to completion. The RWMC emergency coordinator, in consultation with the project NFM, operations manager, and RWMC operations director, is responsible for determining when an emergency situation is sufficiently stable to terminate the emergency and enter the recovery phase. The emergency coordinator, in accordance with Emergency Plan Implementing Procedure-78, "Emergency Event Termination," will consult with the NFM, operations manager, and RWMC operations director and, with concurrence of the emergency director, will decide on termination of the emergency event. The emergency coordinator will conduct a turnover with the assigned recovery manager, who will implement the recovery phase of the event. The emergency coordinator, in accordance with Emergency Plan Implementing Procedure-80, "Recovery," and with concurrence of the emergency director, will appoint a recovery manager. The emergency coordinator will consult with the NFM, operations manager, and operations director to obtain their recommendation for a recovery manager.

Where a restart of Accelerated Retrieval Project operations is required following a shutdown, all operational restart requirements of "Startup and Restart of Nuclear Facilities" (MCP-2783) will be followed.

10.10 Critique of Response and Follow-up

A review and critique will be conducted following all emergency events, drills, and exercises at the INEEL. In some cases, an investigation may be required before commencing recovery actions. For this reason, care should be exercised to preserve evidence when appropriate. The Accelerated Retrieval Project NFM or operations manager will lead all critique of Accelerated Retrieval Project events requiring a critique in accordance with "INEEL Emergency Plan Resource Conservation and Recovery Act (RCRA) Contingency Plan" (PLN-114).

10.11 Telephone and Radio Contact Reference List

A list of the points of contact for the Accelerated Retrieval Project construction and operations will be maintained at the RWMC shift desk.

11. DECONTAMINATION PROCEDURES

The Accelerated Retrieval Project operations will involve decontamination of the excavator, telehandler forklift, operations support equipment, building surfaces, other contaminated items requiring decontamination, and potentially some degree of personnel decontamination. Every effort will be made to prevent contamination of Accelerated Retrieval Project personnel and equipment through the use of engineering controls, isolation of source materials, contaminant monitoring, personnel contamination control training, and by following material-handling requirements and procedures for contaminated or potentially contaminated materials. Where contact with potentially contaminated surfaces or entry into known contaminated areas is anticipated, additional radiological monitoring as described in Section 3 in combination with use of PPE will be necessary to control the hazard. This section provides guidance on how decontamination will be performed.

The Accelerated Retrieval Project facility engineering design features in conjunction with contamination prevention and control practices and proper protective clothing donning and doffing procedures will serve as the primary means to eliminate the need for personnel decontamination. Where decontamination is required, decontamination procedures will be used. "Personnel Decontamination" (MCP-148) contains information on personnel radionuclide decontamination. Radionuclide decontamination operations required for equipment or areas will be performed in accordance with Chapter 4 of "Radiological Control Manual" (PRD-183) and at the direction of RadCon personnel.

11.1 Contamination Control and Prevention

Contamination control and prevention procedures will be implemented to minimize Accelerated Retrieval Project construction and operations personnel contact with contaminated surfaces that will be encountered during project activities. The use of engineering controls, protective barriers, protective clothing, modified work control practices, or addition of hold points and surveys will all be used to minimize direct contact with contaminated surfaces. The following contamination control and prevention measures will be employed:

- Identify potential sources of contamination and design containment, isolation, and engineering controls to eliminate or mitigate any potential for contact or release of contaminants (where feasible)
- Preplan all operational activities where contact with contamination is anticipated, and conduct dry runs to validate operating procedures or maintenance activities as deemed appropriate
- Sleeve or place a disposable barrier between equipment and tools and the contaminated surface or environment (where feasible)
- Limit the number of personnel, equipment, and materials that enter the contaminated area
- Wear disposable outer garments and use disposable equipment (where possible)
- Use hold points defined in procedures and work orders to monitor for contamination where anticipated
- Implement immediate decontamination procedures to prevent the spread of contamination where contamination is found on the outer surfaces of equipment or grossly contaminated clothing during operational activities (including decontamination tasks)

- Use only the established radiological entry and exit control points when accessing contaminated areas to minimize the potential for cross-contamination and expedite contamination control surveys.

11.2 Equipment and Personnel Decontamination

The Accelerated Retrieval Project operational decontamination procedures will be used for routine decontamination of the excavator, telehandler forklift, drum packaging stations, airlocks, and other areas where contamination is anticipated to prevent the spread of contamination and to meet Accelerated Retrieval Project requirements.

Radionuclide decontamination of equipment or areas will be performed in accordance with Chapter 4 of the "Radiological Control Manual" (PRD-183) and at the direction of RadCon personnel. Nonradionuclide decontamination will be conducted in accordance with established project procedures or on a case-by-case basis under the direction of Industrial Hygiene personnel to determine the most appropriate PPE. In all cases, the collection, storage, and disposal of decontamination waste will be addressed before the generation of such waste and stored as described in Section 11.5. Protective clothing and respiratory protection selected for decontamination tasks will be based on the levels of contamination being decontaminated and as described in Section 5.

11.2.1 Equipment Decontamination

The Accelerated Retrieval Project facility engineered isolation controls have been established, where feasible, to prevent contamination of project equipment and facilities from known or suspected sources of contamination. These controls will serve to isolate and eliminate or mitigate many of the potential contamination pathways to prevent equipment contamination and greatly reduce the need for decontamination.

Equipment decontamination will be performed on equipment leaving the Retrieval Enclosure in accordance with established project decontamination procedures or on a case basis as a result of contamination levels. A graded approach will be applied for equipment decontamination using methods to minimize dust creation, personnel exposure, and cross-contamination including but not limited to HEPA vacuuming, misting, wet wiping, and dry wiping as determined appropriate for the contamination levels. Low-cost consumable items will be discarded if initial decontamination efforts fail or extensive decontamination is required that is not in accordance with ALARA principles.

11.2.2 Personnel Decontamination

Engineering controls, in conjunction with facility contamination prevention and control practices and proper protective clothing donning and doffing procedures, will serve as the primary means to eliminate the need for personnel decontamination. The PPE selection, as identified in the RWP and JSA, will provide for the layered barriers required to prevent permeation and minimize external surface contamination.

Instructions for donning and doffing radiological protective clothing will be posted at the entry and exit control points to all contamination areas in accordance with "Radiological Control Manual" (PRD-183). Before donning PPE, all items will be inspected. One of the greatest potentials for personnel contamination exists from improper doffing of contaminated PPE when exiting a contamination area. All operations personnel who enter radiological contamination areas will doff PPE following the posted instructions. If questions or problems arise while doffing (such as tearing protective clothing), guidance and assistance on how to proceed should be requested from the assigned RCT.

11.2.3 Decontamination in Medical Emergencies

Injured or ill personnel should be immediately evaluated by first-aid-trained personnel (within their level of training and on a voluntary basis) within the project area where the incident occurred. The shift supervisor will contact the RWMC shift supervisor or the WCC (if the RWMC shift supervisor cannot be reached) to summon emergency services.

Medical care for serious injury or illness will not be delayed for decontamination. In such cases, gross decontamination may be conducted by removing the injured person's outer protective clothing (if possible) . If contaminated PPE cannot be removed without causing further injury (except for the respirator, which must be removed), potentially contaminated areas of the individual will be wrapped in plastic, blankets, or available material to help prevent contaminating the inside of the ambulance, medical equipment, and medical personnel.

The IH or RCT (depending on the type of contamination) shall accompany the employee to the medical facility to provide information and decontamination assistance to medical personnel. Contaminated PPE then will be removed at the Central Facilities Area medical facility (CFA-1612) and carefully handled to prevent the spread of contamination. Information on proper handling of radionuclide-contaminated wounds is contained in "Personnel Decontamination" (MCP-148).

11.3 Doffing Personal Protective Equipment and Decontamination

Personnel decontamination will likely be limited to doffing of PPE. However, some preliminary surface decontamination of protective clothing may be required if it is grossly contaminated and the potential for the generation of airborne radioactivity or organic vapor emissions exists. This will involve assistance from other personnel inside the contamination area and at the doffing location as described below. The ultimate goal of all decontamination methods is to effectively and efficiently isolate the source of contamination through removal of protective clothing and confinement of the contamination in a sealed bag or waste container.

If contamination is detected on outer PPE layers, careful removal of these outer PPE layers will generally isolate over 99% of surface contamination, and this will serve as the primary decontamination method if protective clothing is contaminated. Removal of contaminated protective clothing using standard radiological doffing techniques (i.e., rolling outer surfaces inward and from top to bottom while being removed) provides the most effective method for containing and isolating the contaminants and greatly reduces the potential for exposure to other personnel who would be put at risk of cross-contamination from other decontamination methods (e.g., washing and brushing).

Where protective clothing also is worn as an anticontamination layer, tape, gloves, booties, and any required dosimetry will be removed following the posted doffing sequence. All PPE will be placed in the appropriately labeled waste containers. Doffing and any required decontamination will take place at the designated contamination area boundary or step-off pad. If exiting a radiological contamination area, personnel will conduct the proper personal survey with hand-held detectors followed by an automated whole-body survey in a PCM (or equivalent), as stated in the RWP.

A general approach for doffing modified Level-D, Level-C, or Level-B PPE is described in Sections 11.3.1–11.3.3. However, no single doffing strategy works for all circumstances. Modifications to this approach are appropriate if operational conditions change or at the discretion of the RCT in consultation with the IH. Both radiological and nonradiological hazards will be evaluated, as applicable.

11.3.1 Modified Level D Personal Protective Equipment Doffing and Decontamination

Modified Level D protective clothing (e.g., Tyvek coveralls and booties) will be doffed following standard radiological removal techniques (as posted) and will constitute the initial decontamination step. If the protective clothing also is being worn as an anticontamination layer, then tape, gloves, booties, and any required dosimetry will be removed following the posted doffing sequence. All PPE will be placed in the appropriately labeled waste container(s) for disposal. Doffing and any required decontamination will take place at the boundary between the contaminated area and the step-off pad. Doffing will be followed by conducting a personal contamination survey, as stated in the RWP.

Note: Under some radiological conditions, two sets of anticontamination clothing may be worn. When required, the posted instructions will address the proper doffing sequence for both sets.

11.3.2 Level C Personal Protective Equipment Doffing and Decontamination

Where respiratory protection is worn in conjunction with protective clothing (Level C PPE), the modified Level D sequence will be followed with one additional step. Following protective-clothing doffing, respirators will be removed and placed in a separate container. A survey of the face and sealing surfaces of the respirator then will be performed by the RCT or as part of the posted survey instructions by the respirator wearer. Doffing and any required decontamination will take place at the designated RadCon boundary as described above. If exiting a radiological contamination area, personnel will conduct the proper personal survey, as stated in the RWP.

11.3.3 Level B Personal Protective Equipment Doffing and Decontamination

The distinction between Level C and B PPE will be the addition of supplied air respiratory protection. Respiratory protection may be in the form of a bubble hood or airline respirator. The doffing sequence when using a supplied airline is slightly more complicated than Level C respiratory protection, and all operations personnel who will enter an area with Level B PPE must have a clear understanding of the doffing sequence before entering the area. It will be necessary to disconnect and tape over the supplied airline before exiting the contamination area. The RCT will assist personnel exiting these areas and doffing instructions will be posted and must be followed. Doffing and any required decontamination will take place at the designated radiological control boundary as described above. If exiting a radiological contamination area, personnel will conduct the proper personal survey, as stated in the RWP.

11.4 Personnel Radiological Contamination Monitoring

Radiological surveys (with hand-held detectors and an automated whole-body PCM) will be required before personnel exit project operational areas as stated on the RWP. The purpose of this hand-held instrument survey is to detect surface contamination. If survey instruments or the PCM alarms indicate elevated contamination levels are present, personnel should remain in the area and contact RadCon (or have someone in a nonradiologically controlled area contact RadCon). When exiting a contamination area or contamination radiological buffer area, an automated whole-body survey using a PCM station (or equivalent) must be conducted before using designated eating or smoking areas.

11.5 Storage and Disposal of Operational Waste Materials

Waste generated from decontamination and other project operational activities will be properly characterized, stored, and disposed of in accordance with the following documents:

- *Waste Management* (Manual 17)
- Established project procedures
- Waste disposal and disposition forms.

11.6 Project Sanitation and Waste Minimization

Project personnel will use washroom and restroom facilities located within the project operational areas and the RWMC area. Potable water and soap are available within the project operations areas for personnel to wash their hands and faces.

Industrial waste materials will not be allowed to accumulate at the project operational areas. Appropriate containers for industrial waste will be maintained within the project operational areas. Personnel should make every attempt to minimize waste through judicious use of consumable materials. All project operations personnel are expected to make good housekeeping a priority.

12. RECORDKEEPING REQUIREMENTS

12.1 Industrial Hygiene and Radiological Monitoring Records

The IH assigned to the Accelerated Retrieval Project will record airborne monitoring and sampling data (both area and personal) collected for project operational exposure assessments in the INEEL Hazards Assessment and Sampling System Database. All monitoring and sampling equipment will be maintained and calibrated in accordance with INEEL procedures and the manufacturer specifications. Industrial Hygiene airborne monitoring and sampling exposure assessment data are treated as limited access information and maintained by the IH in accordance with INEEL safety and health manual procedures (Manual 14A; Manual 14B).

The assigned RCTs will maintain a logbook of radiological monitoring, daily project operational activities, and instrument calibrations where instruments were used to document detection levels or conduct field screening of samples. Radiological monitoring records will be maintained in accordance with *Radiation Protection Procedures* (Manual 15B), "Radiological Control Manual" (PRD-183), and "Maintaining the Radiological Control Logbook" (MCP-9).

All other health, safety, and radiological records, including inspections, will be maintained in accordance with appropriate and applicable requirements identified in *Safety and Health—Occupational Safety and Fire Protection* (Manual 14A), "Radiological Control Manual" (PRD-183), *Radiation Protection Procedures* (Manual 15B), *Radiological Control Procedures* (Manual 15C), and applicable RWMC and project supplements.

12.2 Records Management

The Idaho Completion Project Administrative Record and Document Control office organizes and maintains data and reports generated by field activities. The Administrative Record and Document Control office maintains a supply of all controlled documents and provides a documented system for the control and release of controlled documents, reports, and records. Copies of project plans; this HASP; the quality program plan; the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Inactive Sites* (DOE-ID 2000); and other documents pertaining to these operations are maintained in the project file by the Idaho Completion Project Administrative Record and Document Control office. Controlled procedures for the RWMC and Accelerated Retrieval Project will be issued, controlled, and maintained in accordance with "Creating, Modifying, and Canceling Procedures and Other DMCS-Controlled Documents" (MCP-135) and applicable RWMC or project supplemental MCPs.

All additional project records will be maintained in accordance with applicable federal and state procedures, companywide manuals, and project-specific supplemental procedures.

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